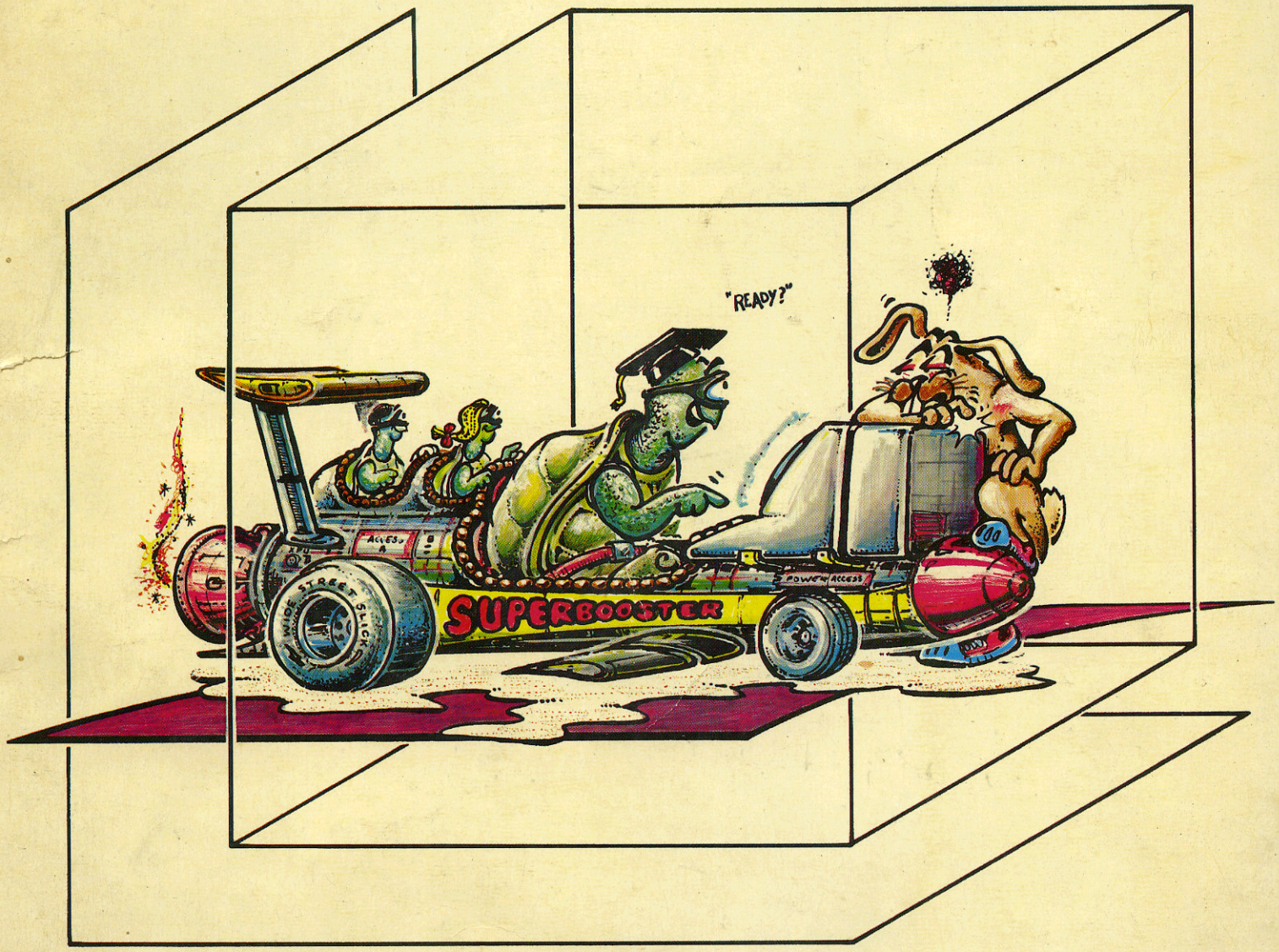
1,2,3 MY COMPUTER & ME!

A LOGO FUNBOOK FOR KIDS



DONNA BEARDEN

ILLUSTRATIONS BY C. MICHA

1,2,3, My Computer and Me

1,2,3, My Computer and Me

by Donna Bearden
Young Peoples' LOGO Association

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. . . this book is for you, Jack!

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Dear Parents,

Are you among the growing number of adults who can't understand their children? I'm not talking psychology here; I literally mean that you find yourself unable to follow what your children are saying. Something about RAM or ROM, loops and bugs?! Or have you recently found yourself tightly clutching your quarters, wondering whether or not you should yield to your seven-year-old's plea to play Pac Man™ or Donkey Kong™ "just one more time."

Welcome to the world of the computer! And the fact is — unlike hulahoops and pet rocks — the computer is here to stay. You have to either acknowledge its presence or dig yourself a very deep hole.

Assuming that you choose acknowledgment, then what? Then this book might be for you and your children. **1,2,3, My Computer and Me** isn't a book about machines, at least not in the sense of RAM and ROM and integrated circuits. Nor is it a book about games, although it relishes the value of play. Rather it is a book about learning and is written in such a way that children who use it will want to learn.

1,2,3, My Computer and Me is written in two languages — English and LOGO. LOGO is a computer language that children can learn with relative ease. Through this language they are able to command the movements of a cybernetic Turtle around the screen. These movements reflect the child's understanding of concepts, particularly those that relate to the content of geometry. But more importantly, the movements of the Turtle allow a child to "see" how he is thinking. When the sequence of his thoughts doesn't take him where he intended, the descriptive nature of the LOGO language allows the child to easily retrace his thoughts or to pursue an unintended tangent. Off-computer activities such as designing with cut-out geometric shapes, walking out patterns for the Turtle to draw,or working with a stringboard (directions to make one are included) will help children develop a feel for how to make things happen on the screen.

1,2,3, My Computer and Me invites children into a world of powerful mathematical ideas and into the world of their own thoughts and imaginations. It's an exciting world for children and an equally exciting one for us grown-ups. Why not try it? Join with your child in exploring the LOGO Funbook. Go as fast or as slow as you want. Follow the sequence provided in the book or make up your own. Whatever you do, remember it's a FUNbook. Enjoy it!

Sincerely,
Kathleen Martin, Ph.D.
University of Dallas

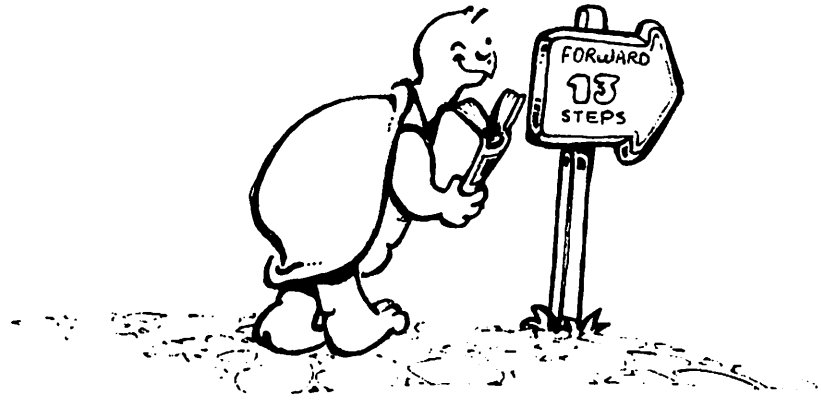
A WORD

LOGO is a fun computer language for everyone from 2 to 102. The fun part is that YOU are in charge! YOU direct the action! YOU make all the decisions!

To help you get started, we put together this FUNBOOK. When we started, there were only three versions of LOGO. Now there are more and more becoming available every day. So while this book was written for Apple (both Apple and MIT versions) and TI, the ideas will transfer to other computers. Some of the commands may differ slightly but making it work is part of the fun of LOGO.

A lot of young people just like you helped us put this book together. And we'd like your help, too. After you get started, write us a note and tell us what you like to do with LOGO, or just say "Hi!" We'd love to hear from you.

Young Peoples' LOGO Association
1208 Hillsdale Drive
Richardson, Texas 75081



THIS IS MY LOGO FUNBOOK

Circle your choices and watch for special directions as you work through this book.

I will be using a(n) _____ computer.

TI 99/4 **TI 99/4A** **APPLE**

For APPLE users: I will be using the _____ version of LOGO.

APPLE **MIT** (Marketed by Terrapin, Inc. and Krell Software Corporation)

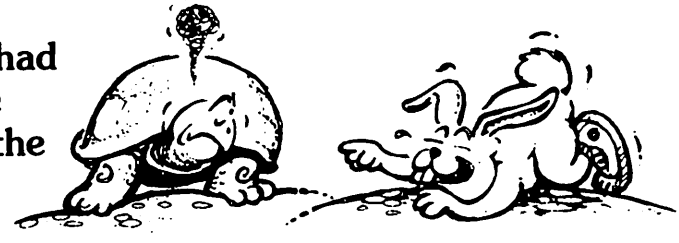
A STORY

Once upon a time there was a tortoise who moved along very slowly but steadily. And once upon that same time there was a hare who leaped and hopped all about. Now the hare was constantly teasing the tortoise about his slow steady pace, but the tortoise never retorted. He just kept minding his own business, moving steadily forward step by step.

But one day, he had just had it with the hare who had teased him one too many times.

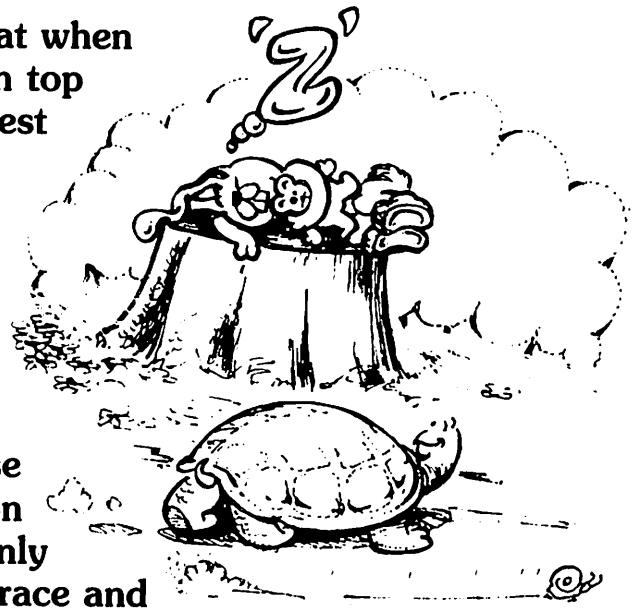
"Hare," he said, "I challenge you to a race. Whoever can make it to the other side of the forest and back first is the winner."

The hare laughed so hard he had to hold his sides and roll on the ground. He readily agreed and the race began.

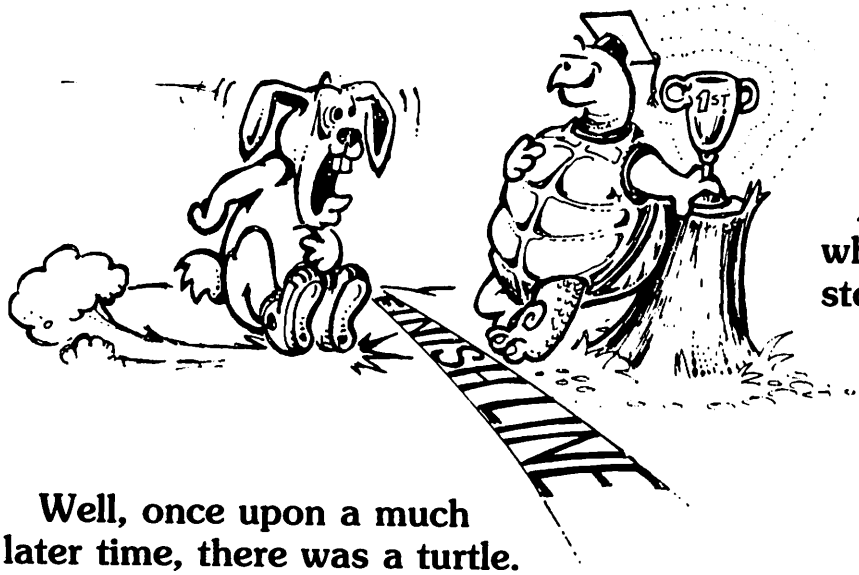


The tortoise started off at a slow but steady pace, — step, step, step, never faster, never slower. The hare leaped and hopped and did cartwheels around the tortoise, and then he sped off toward the other side of the forest.

The hare was so sure of himself that when he found a nice, warm, sunny spot on top of a big tree stump, he lay down to rest for a minute. The sun was so warm and he was so comfortable that he fell fast asleep and didn't wake up, even when the tortoise came plodding along right in front of him.



As you have probably already guessed, or you already know because your Grandfather read the real version of this story to you when you were only three years old, the tortoise won the race and the hare was very embarrassed and never teased the tortoise again.



And that's probably where your Grandfather's story ended.

Well, once upon a much later time, there was a turtle. He was a distant cousin of the grandchild of the now-famous tortoise. And, of course, there was a rabbit (a distant cousin of the grandchild of the now-infamous hare.)

Both the turtle and the rabbit were given the opportunity to learn about LOGO and computers. They were both delighted and couldn't wait to see what they could do.

The turtle opened his FUNBOOK to page one and began to read and experiment step by step.

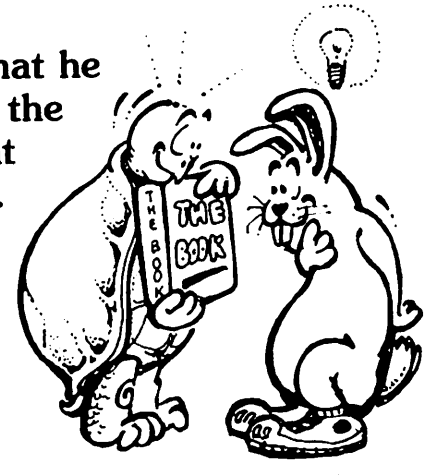
The rabbit glanced at Chapter I, which was such an easy chapter that he understood it at once, and then he moved quickly on to other chapters. He tried one thing from one chapter and another from another chapter. He bounced from one to another, back and forth, and then he glanced over at the turtle who was still on Chapter I.

"Hey, that's easy stuff," he said. "Look at this!"

The turtle was impressed with what the rabbit could do, but he was having so much fun on his own, and he seemed to know that if he kept working steadily along, he would eventually be able to do the marvelous things the rabbit was doing.

Weeks passed and the rabbit was still bouncing from one thing to another. By now the turtle was up to Chapter 2.

One day, the rabbit glanced over the turtle's shoulder. He was just about to say, "Are you still on the easy stuff?" but when he saw the screen, he looked puzzled and said, "Hey! How'd you do that?"

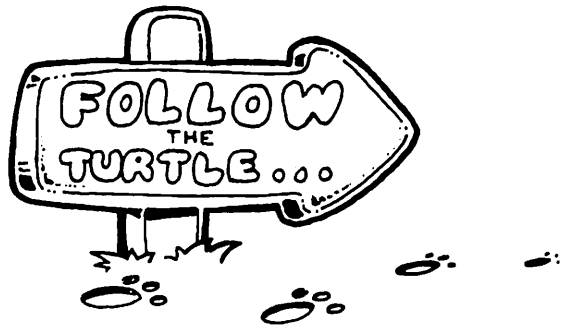


The turtle explained slowly step by step what he had done to make the wonderful drawing on the screen, but the rabbit didn't understand. That wonderful drawing was nowhere in the book. He knew because by now he had tried every example in every chapter.

"But, Rabbit," explained the turtle, "my drawing's not in the book. I made it up."

"But how did you do that?" questioned the rabbit. "How did you know what to do?"

"It's all in the book, Rabbit," said the turtle. And he turned the page to Chapter 3.



As we wrote this book, we tried to think about both the turtle and the rabbit, and we tried to include something for both of them.

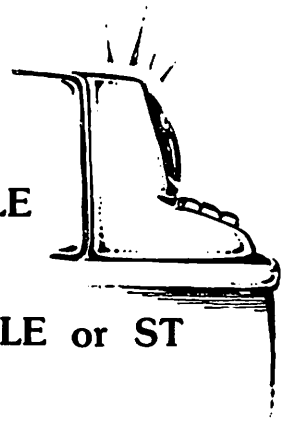
For the rabbit, there are examples in every chapter. If you want to jump from chapter to chapter, back and forth, that's OK.

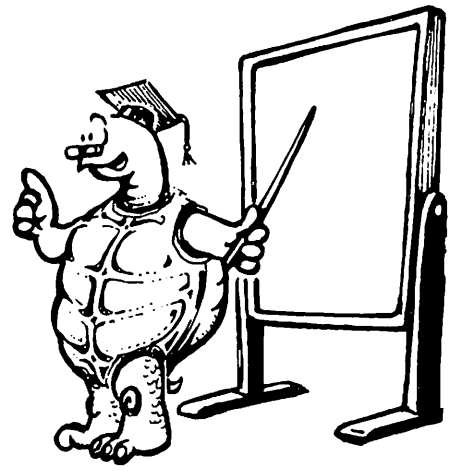
What we really hope is that you will follow the turtle. He spent a lot of time on each page and really learned it before moving on to the next. He didn't stop with our examples but made up his own. And when he got to the end of the book, Boy!! Could he make up some neat designs! In fact, we've asked **him** to write the next book!

CHAPTER 1
MEET THE TURTLE

One was a turtle, a fellow quite fine.
He drew shapes for Carlos while trailing a line.

LEARNING COMMANDS





Let's get started! Type:

TI TELL TURTLE

APPLE SHOWTURTLE or ST

MIT DRAW

Presto! There's the turtle, ready and waiting for your commands! He's at HOME in the center of the screen. He knows four commands:

FORWARD or FD

BACKWARD or BK

RIGHT or RT

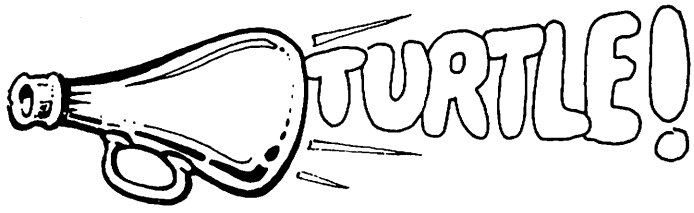
LEFT or LT

Each of these commands must be followed by a space and a number. The number tells the turtle how far to go or how much to turn. Every time you give the computer a command, you must press:

TI ENTER

APPLE RETURN

That let's the turtle "hear" you.



Any time you want to CLEAR your SCREEN and start over, type CLEARSCREEN or just CS. If the turtle has wandered away from the center, you can bring him back by typing HOME. (Remember to press ENTER or RETURN so he'll hear you.)

Try a few commands:

FD 118

RT 25

BK 72

LT 95

FD ____

LT ____

BK ____

____ ____

____ ____

____ ____

Did you ever type a letter that you didn't mean to type? Here's what to do:

TI 99/4 Hold the SHIFT key down and press T to erase.

TI 99/4A Hold the FUNCTION key down and press 3 to erase.

APPLE Press the left (←) arrow key to erase.

MIT Press the ESC key to erase.

Sometimes you'll see a message like this:

TI TELL ME HOW TO _____

APPLE THERE IS NO PROCEDURE NAMED _____

That means the turtle needs some help understanding what you want to do. Did you forget to put a space between the FD and the number? Did you type FB instead of FD? No problem! Just type your command again. The turtle is very patient. If you haven't seen the message yet, why don't you go ahead and type FB 20 so you can see it?

Suppose you want to move the turtle without drawing. He knows a command that makes that possible:

PENUP or PU

After you move the turtle where you want him, use PENDOWN or PD to tell him to draw again.

Try this:

PU	PU
FD 50	RT ___
PD	FD ___
FD 25	PD
RT 30	___ ___
FD 25	___ ___

Suppose you want to erase one line without erasing your whole drawing. The turtle can do that, too. The command is:

TI/APPLE PENERASE or PE

MIT PC 0 (and PC 1 to make him draw again)

After you give the command, have the turtle go back over the line you want erased. Try it!

TI/APPLE	**MIT**
FD 50	FD 50
RT 45	RT 45
FD 70	FD 70
PE	PC 0
BK 70	BK 70
PD	PC 1
____	____
____	____

Do you realize you have already learned nine commands?! Can you name them?

_____ or ____

_____ or ____

_____ or ____

_____ or ____

_____ or ____

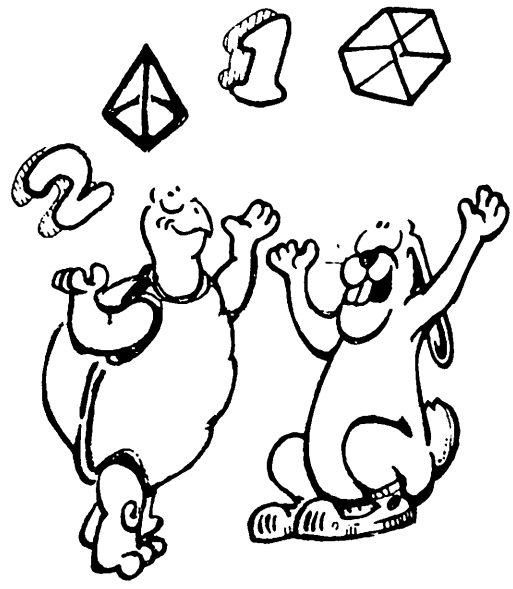
_____ or ____

_____ or ____

_____ or ____

_____

TI Your turtle is a very friendly little pet, and he always likes to know if you are getting ready to turn off the computer. So always type BYE and press ENTER before you leave him. He has a nice sign-off message for you, too.



Let's use all those commands we've learned. Let's EXPERIMENT! You'll see that word a lot in this book. It just means to play around a lot with different numbers, commands, shapes, and all those other fun things.

Here are some ideas to get you started and some space to write down your own ideas.

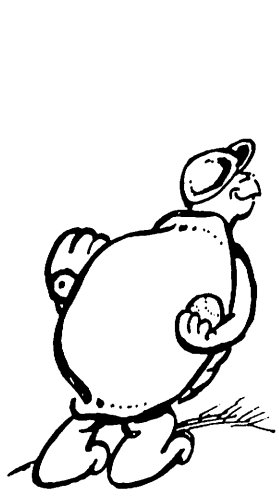
EXPERIMENT 1 Introduce Yourself to the Turtle.

Can you make the turtle draw the first letter of your name?

HAPPY

EXPERIMENT 2 Turtle Baseball

Put four stickers on the screen in the shape of a baseball diamond. Home plate should be at HOME. See if you can make the turtle "run" the bases. This is a good game to play with a friend. Try to make it around with the least number of commands.



EXPERIMENT 3 How Big is the Screen?

Starting at HOME, how many steps can the turtle take before he goes off the top of the screen and appears at the bottom? (That's called **wrapping.)** How far can he go to the left before he wraps around and appears at the right? Can you point him to the upper righthand corner and see how many steps he can take?

Now make up some experiments of your own!

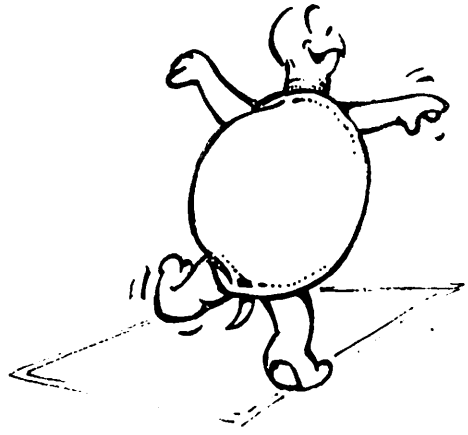
EXPERIMENT 4

EXPERIMENT 5

EXPERIMENT 6

MAKING SHAPES

Now that you've had lots of practice with all those commands, let's put some of them together to make a shape. How about a square? If you were the turtle, how would you draw a square? Stand up and pretend you're the turtle. Whenever you're trying to figure out how to tell the turtle to do something, it helps to "play turtle." Stand up and walk through the motions yourself or tell a friend how to do it. Then it's easier to figure out the commands for the turtle.



OK, play-turtle, walk in a square. Did you go forward, turn, forward, turn, forward, turn, forward, turn? That's exactly what the turtle will have to do. The question is how far to go forward and how much to turn. Do you want a BIG square or a small square?

I want a _____ square so I'll go FD ____

Now, how much do you turn?

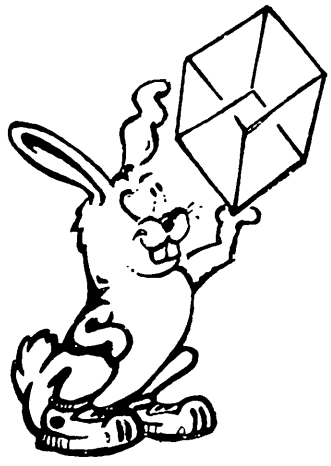
EXPERIMENT. Can you make a square corner?

Since we're trying to figure out how much to turn, keep the FD number the same each time and just play with the RT number.

FD ____

RT ____

FD ____



Does it look like a square corner? It's also called a right angle, even though you can make one by turning left, too. If it doesn't look like a right angle, clear your screen and try again.

Write down the numbers you try and whether they are too big (turned too much) or too small (didn't turn enough).

I tried these numbers:

____ was too _____	____ was too _____
____ was too _____	____ was too _____
____ was too _____	____ was too _____
____ was too _____	____ was too _____
____ was too _____	____ was too _____

THE ANSWER IS _____!!!

Now I can make a square:

FD ____ RT ____ FD ____ RT ____ FD ____ RT ____ FD ____ RT ____

It's a good idea to have the turtle end up facing the same direction he started. That's why we included the last RT turn.

Give yourself a pat on the back or a double-dip ice cream cone! You've worked hard!

If you made a big square, now try to make a small square. If you made a small one, try to make a giant one! Will you have to change the FD number or the RT number? Time for some more experimenting!

This is how I made a BIG square:

FD ____ RT ____ FD ____ RT ____ FD ____ RT ____ FD ____ RT ____

This is how I made a little bitty square:

FD ____ RT ____ FD ____ RT ____ FD ____ RT ____ FD ____ RT ____

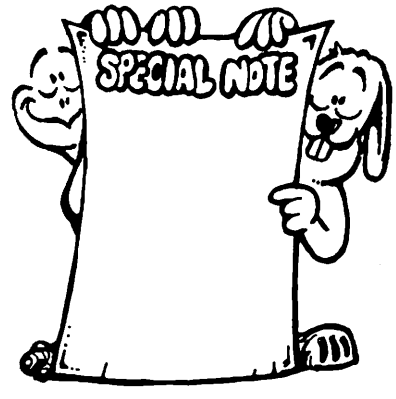
And I even made a middle-size square:

FD ____ RT ____ FD ____ RT ____ FD ____ RT ____ FD ____ RT ____

It seems like it takes a lot of typing just to make a square. Let's try a short-cut. It's called a REPEAT command and it looks like this:

REPEAT 4 [FD ____ RT ____]

(Fill in the FD number depending on what size square you want. And you just figured out that to make a square, the turtle must always turn ____.)



SPECIAL NOTE

If you use parentheses instead of brackets in this command, it confuses the turtle and he doesn't know what to do. The brackets are made by using:

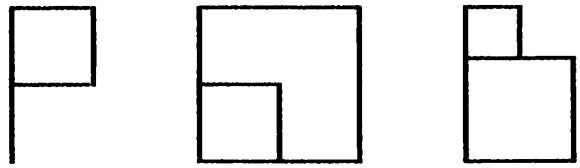
TI 99/4 SHIFT 4 for the [and SHIFT 5 for the]

TI 99/4A FNCT R for the [and FNCT T for the]

APPLE SHIFT N for the [and SHIFT M for the]

Hey! Can you make a square inside a square? How about a big square on a small square? Can you use PENUP and PENDOWN to put a square in each corner? How many things can you do with squares? 27? 39? 977?

These are some things I can do with squares:



Did you ever realize all the things you can do with squares?! Wow! Don't forget to write down your experiments!

OK! Are you ready to tackle a triangle? Triangles have three sides and three corners or angles. All the sides can be the same length or they can be different. If the sides are all the same, all the angles will be the same. If the sides are different, the angles will be _____. (If you said "different," you are absolutely correct!)

Let's try the one with equal sides and equal angles. If you want to impress your Mom, it's called an **equilateral triangle.** "Equi" means equal and "lateral" means side — equal-side. Enough about words; on with the action.

EXPERIMENT. Try to figure out how much the turtle will have to turn to make an equilateral triangle. In order to see if the third line meets the first, you might want to make the turtle disappear. Don't worry, though; you can call him back anytime you want. To make him disappear, use:

HIDETURTLE or HT

To make him come back, use:

SHOWTURTLE or ST

Ready — Set — GO!

FD 50

RT ____

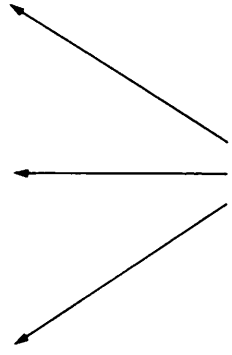
FD 50

RT ____

FD 50

RT ____

HT



(Use the same number for all three turns.)

(Remember to have the turtle end up facing the same direction he started.)

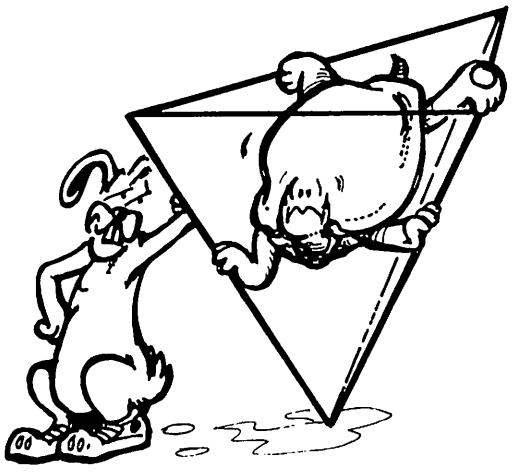
Try some numbers. If the number is too big, the third line will cross the first. If the number is too small, the third line won't meet the first.

____ was too _____	____ was too _____
____ was too_____	____ was too _____
____ was too _____	____ was too _____
____ was too _____	____ was too _____
____ was too _____	____ was too _____

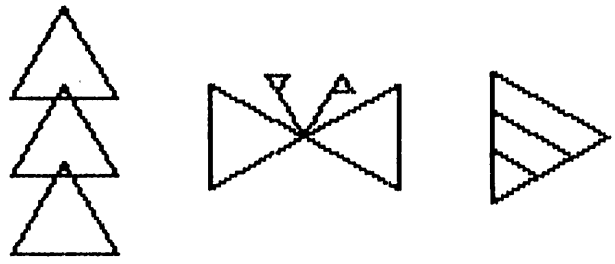
THE ANSWER IS _____!!!

WOW! You did it! Now can you figure out how to do the REPEAT command for a triangle?

REPEAT ____ [FD ____ RT ____]



13 or More Things I Can Do with Triangles



Do you know what an open-book test is? It's a test not so much to see if you can memorize a lot of facts and figures but to see if you know where to find the answers. In other words, you can keep your book open and look up the answers. Many times it's a lot more important to know where to look for information about something than it is to know all about that particular something.

We might try a few of those things as we play through this book. We won't use the word "test" because it scared the rabbit all the way to Mississippi and even the turtle got a little nervous. We already had a what-cha-ma-call-it back when we listed all the commands we had learned and I bet you didn't even get sweaty palms. So try a few questions on squares and triangles:

A square has ____ sides and ____ angles.

A triangle has ____ sides and ____ angles.

To make the corner (angle) of a square, turn ____.

To make the corner (angle) of a triangle with three equal sides, turn ____. (A triangle with three equal sides is called an _____ triangle.)

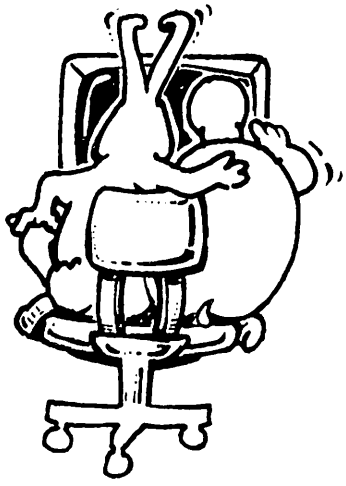
If you add the angles of a square, you get _____.

_____+_____+_____+_____=_____

If you add the angles of a triangle, you get _____.

_____+_____+_____=_____

Hmm, I wonder if that's important...



PLAYING GAMES

Learning LOGO is especially fun if you're learning with a friend. Can you and your friend make up some games using the commands you've learned so far? Here's a game made up by a seven-year-old:

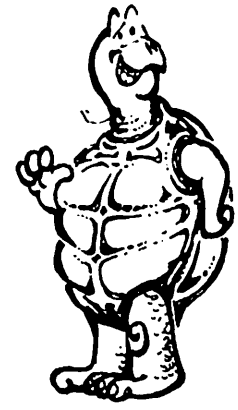
Connect the Shapes

Using the PENUP and PENDOWN commands, the first player draws three or four small shapes anywhere on the screen. The second player then tries to connect them with the least number of commands. If you overshoot your mark and have to back up, that counts as two moves.

Add to My Drawing

Each player can give the Turtle two commands. Take turns and see what happens.

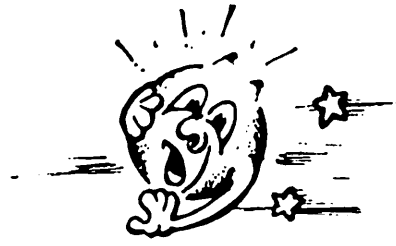
A Game I Made Up!

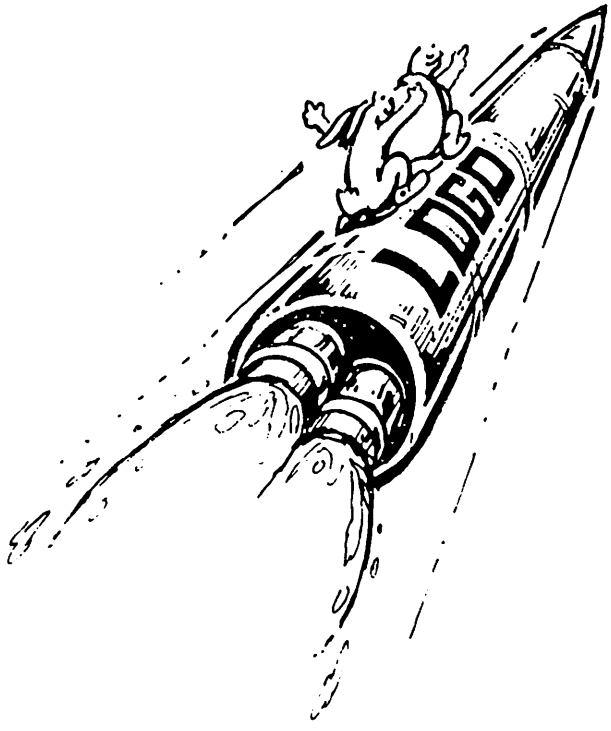


A Game My Friend Made Up!

NOTES

CHAPTER 2
TEACH THE COMPUTER

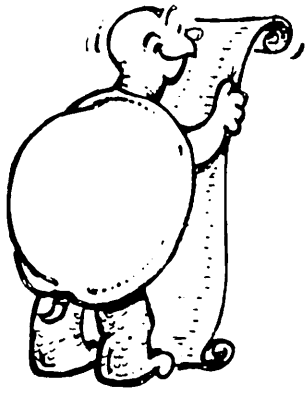




Two was a HOW TO, a wonderful trick.
Stacy and Carrie took off real quick.

WRITING PROCEDURES

Now that you know the basic turtle commands, you're in for some real fun. You can make up your own commands and teach them to the turtle. Let's start with a square again. We'll teach the turtle to draw a square every time we give it a certain command. We can name the command anything we want to: SQUARE, BOX, ALFRED, ELIZABETH...



For this example, we'll use BOX since it's easy to remember and easy to type. We'll make it 50 turtle steps on a side for starters. Later you'll learn how to change the 50 to any number you want.

Ready? Type:

TO BOX

and press ENTER or RETURN.

TI Wow! The screen changed colors! Press ENTER again to get the cursor down to the next line. Now type in the instructions for making a square. The screen should look like this:

```
TO BOX
REPEAT 4[FD 50 RT 90]
END
```

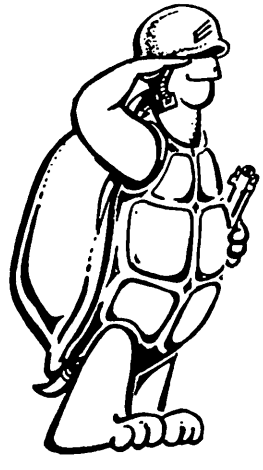
To leave the edit mode:

99/4 Use SHIFT Z.

99/4A Use FNCT 9.

APPLE The question mark at the lefthand side changed into a > . Type in the instructions for making a square and press RETURN. Then type END and press RETURN. You'll see the message BOX DEFINED.

MIT When you type TO BOX and press RETURN, the screen changes. TO BOX is at the top lefthand corner and the cursor is on the next line. Type the instructions for making a square and press RETURN. Then type END. To leave the edit mode, hold the CTRL key down and press C. (By the way, if you make a typing mistake in the edit mode, use the arrow keys to place the cursor on the character you want to change and use CTRL D to delete. Then type the new character.)



You have now defined a procedure called BOX. Type BOX, press ENTER or RETURN, and watch how obedient that little turtle is!

EDITING

There may be times when you want to change the procedure. Maybe you want the turtle to draw smaller boxes or BIGGER ones. In that case you will have to edit the procedure. Here's how:

TI Type TO _____ (the name of the procedure you want to edit).

99/4 Hold the SHIFT key down and use the arrow key to get just past the word or number you want to erase. Use SHIFT T to erase. Type in the new word or number. Then press SHIFT Z to leave the "edit mode."

99/4A Hold the SHIFT key down to get just past the word or number you want to erase. Use FNCT 3 to erase. Type in the new word or number. Then press FNCT 9 to leave the "edit mode."

APPLE Type EDIT "_____ (the name of the procedure you want to edit). Use the right arrow key to get just past the word or number you want to erase and the left arrow key to erase it. Then type in the new word or number. To leave the "edit mode," hold the CTRL key down and press C.

MIT Type TO _____(the name of the procedure you want to edit). Use the arrow keys to place the cursor on top of the characters you want to change. Use CTRL D to erase. Then type in the new words or numbers. Use CTRL C to leave the edit mode.

NOTE TO ALL TURTLES

There are some other editing tricks you can learn, and they're listed in the back. For now, these will probably be all you need.

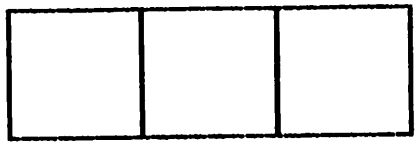
SAVING PROCEDURES

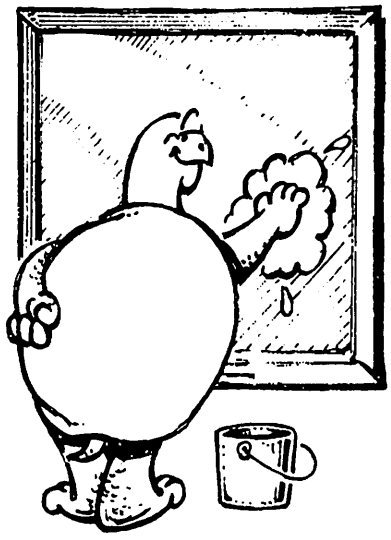
The procedures you teach the turtle will be very helpful in drawing designs and pictures so you might want to save them on a disk or cassette tape. Refer to your owner's manual for directions on how to do this.

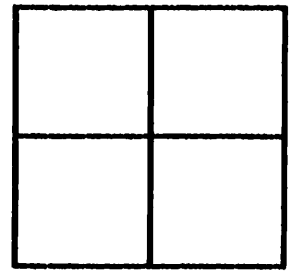
BACK TO BOXES

Try putting BOXes all over the screen. Line 'em up. Stack 'em up. Do all kinds of things. Here are a few ideas for you to try and plenty of space to write down what you do. Don't forget to make up some of your own!

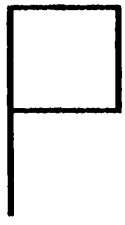
Sidewalk



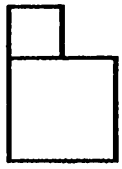




Window

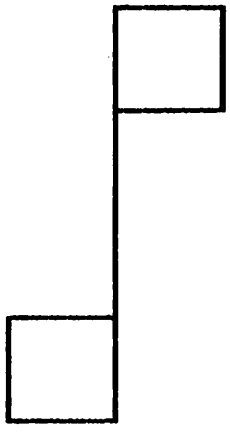


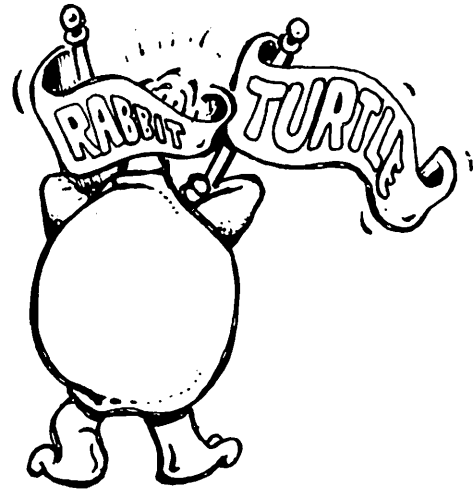
Flag



Stack

Doubleflag





That was so much fun, let's try a triangle. Let's call it TRI since that's easier to type. Do you remember the steps for defining a procedure?

ALL First type TO _____ and press _____.

TI Press _____ again to move the cursor down to the next line.

ALL Type the instructions for a triangle. They are:

REPEAT ___ [FD ___ RT ___]

To define the procedure and leave the edit mode:

TI Hold the _____ key down and press _____.

APPLE Type _____

MIT Type _____. Then hold the _____ key down and press _____.

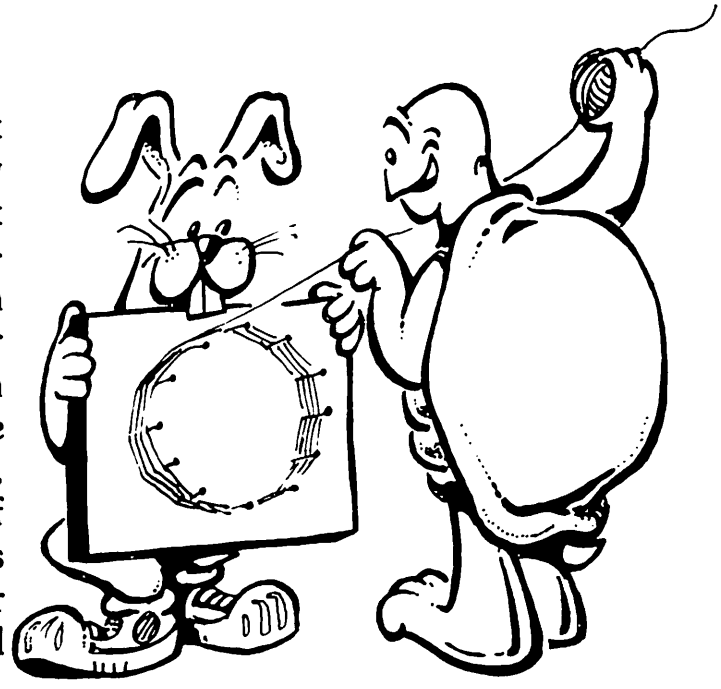
Slipped another one of those open-book thing-a-ma-jigs in on you. How did you do?

A. Super.
B. Great.
C. I'm a genius in disguise.

STRING BOARD

There are many ways to figure out designs for your turtle to draw: pencil and paper, cut-out paper shapes, string...Sometimes the hardest thing to figure out is how much the turtle should turn. Here's something that's fun to make, fun to play with and will help you figure out turtle turns all at the same time — not bad for a piece of scrap lumber, a few nails and a piece of string!

Find a board and cut it to about nine inches by nine inches. Draw a circle on the board and mark it off like you would a clock. Hammer a nail into the circle at each of the marks. Hammer another nail into the center. Tie a loop in one end of your string or yarn. The string represents the turtle trail, and you can make all kinds of designs with it. The center nail is HOME, so start with the loop over that nail. Try an hour-glass and then a hexagon, a six-sided figure.

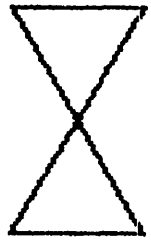


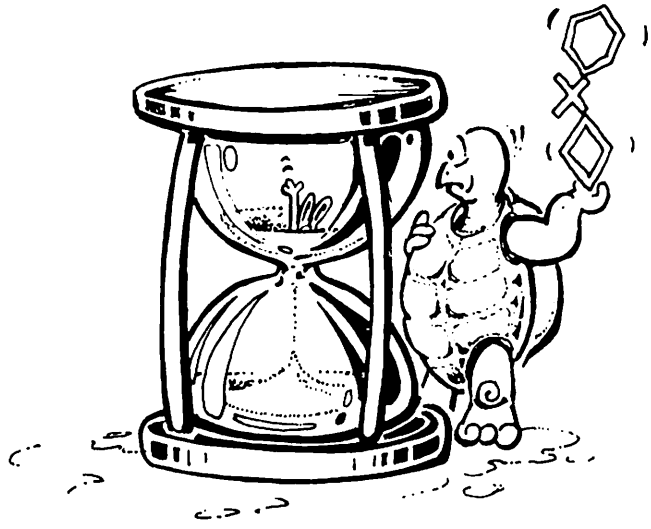
If you start the string at 12 o'clock and go to the center and then to 3 o'clock, you've made a square corner! Remember how the turtle makes a square corner? He turns 90. If the turtle is at HOME facing 12 o'clock and turns to face 1 o'clock, how far will he turn? Since the space between the 12 o'clock and the 3 o'clock is divided into three equal sections, we could divide 90 by 3 to find out. Let's try it on the computer and see if it works.

With the turtle at HOME, go FD 40 and BK 40. The turtle is back at HOME still facing the same way he started. Now turn RT 30 (90 divided by 3) and go FD 40 and BK 40 again. Continue turning RT 30 and drawing another spoke by going FD 40 and BK 40. How many spokes do you end up with if you go all the way around? Hey, just like a clock! Ah ha! That means if the turtle is facing 12 o'clock and turns to face 11 o'clock he turns LEFT ____. So if you want to make an hourglass, the first command would probably be ____ ____. You can use your string board and the clock concept to help you figure out lots of turtle turns!

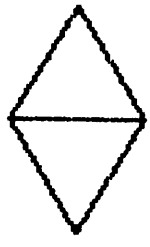
Can you figure out how to do these triangle designs?

Hourglass

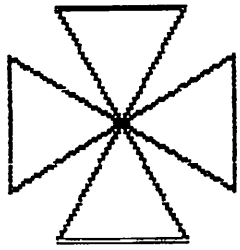




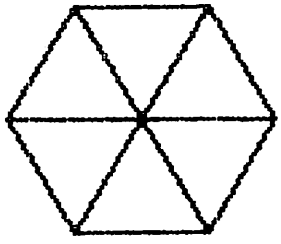
Diamond



Cross



Hexagon

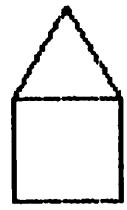


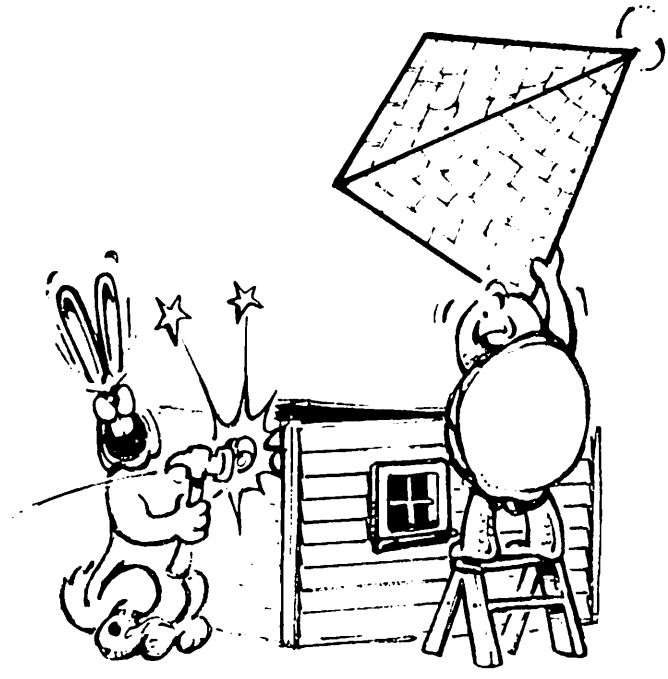
Now that your turtle has had lots of practice with squares and triangles and some of the 1001 things you can do with them, let's use them together. Using PENUP and PENDOWN (PU and PD), can you fill the screen with squares and triangles?

Use this page to draw something using both squares and triangles.

Now let's pick a simple shape and teach the turtle how to draw it with our BOX and TRI commands. By putting a triangle above a square we can make a simple house. If we work at it real hard, we can probably figure out how to write a new procedure called HOUSE. This is not quite as easy as it looks. The rabbit got discouraged after the first try. The turtle figured out that the first command for HOUSE is BOX. He had to experiment quite a while to figure out the rest. He knew one of the commands would be TRI. Can you help him?

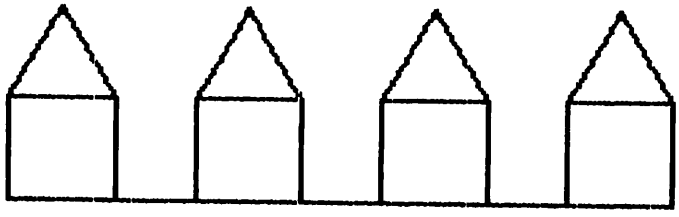
```
TO HOUSE
BOX
_____
_____
_____
END
```

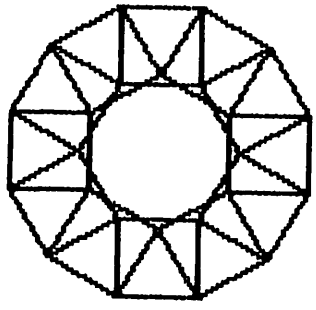




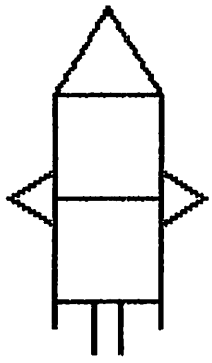
Here are a few things the turtle did with the HOUSE command after he worked it out. Can you figure out how he did them?

Neighborhood



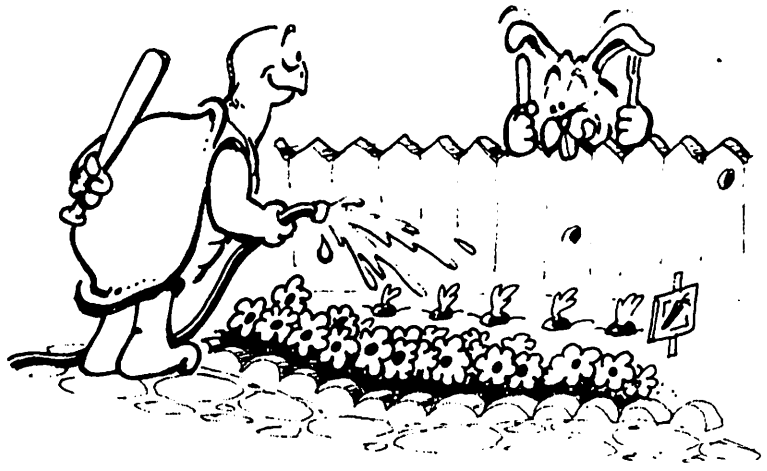


Wheel



Rocket

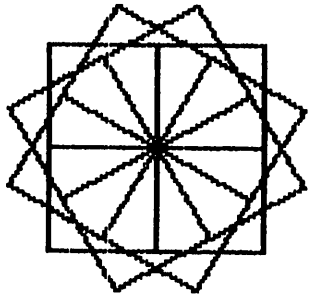
My own designs:



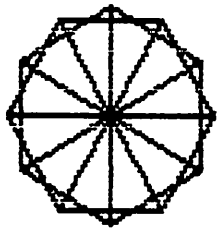
FLOWERS

Did you know turtles really like flowers? Rabbits like them too, but usually they're growing in someone else's garden.

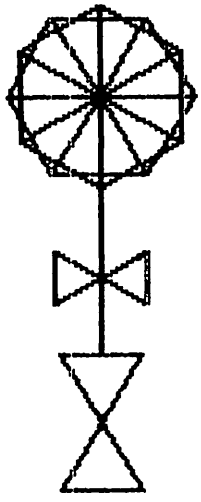
The turtle figured out how to spin BOX so it looked like a flower. He drew one BOX, turned RT 30, drew another BOX, turned RT 30, etc., until he got all the way around. Why don't you try it! Then try it with a RT turn of 20 or 10.

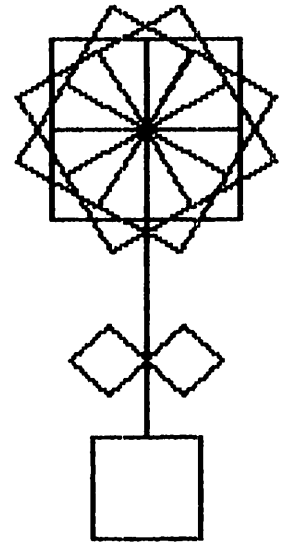


Can you do it with a triangle?

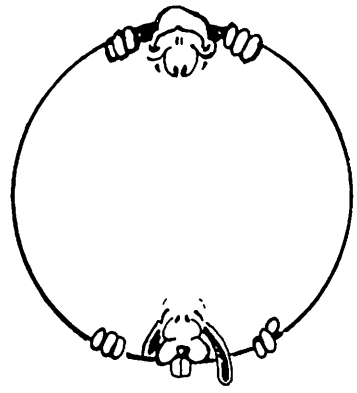


Can you draw a flower at the top of the screen and then, using PENUP and PENDOWN, add a stem and leaves, and maybe even a flower pot?





CIRCLES



Did you notice that when you spun the square it almost became a circle? Or at least the overall design is circular. Let's try to teach the turtle to draw a circle. Time to play turtle again. Stand up and walk in a circle. Did you go forward one step and turn a little, go forward one step and turn a little more? Did you repeat that until you got all the way around?

Now try to make the turtle do the same thing on the screen. How many times would he have to repeat [FD 1 RT 1] to make a complete circle? Try some numbers:

REPEAT _____[FD 1 RT 1]

Write down the numbers you try. Either you can clear your screen and try a different number each time, or you can keep adding to what you've already done. Be sure to write down the numbers and add them up to figure out the grand total. In other words if you start out by trying REPEAT 10 [FD 1 RT 1] and that's not enough, you might want to try REPEAT 20 [FD 1 RT 1]. You have now repeated the command in the brackets 30 times. Here's some space to write down the numbers you try and to draw some shooting stars when you figure out the right number.

REPEAT ____ [FD 1 RT 1]

REPEAT ____ [FD 1 RT 1]

REPEAT ____ [FD 1 RT 1]

REPEAT ____ [FD 1 RT 1]

REPEAT ____ [FD 1 RT 1]

REPEAT ____ [FD 1 RT 1]

THE ANSWER IS _____!!

Ah ha! Remember when we wondered earlier if that number was important? There it is again!

What would happen if you changed 360 to 180? Try it! Draw a picture of what happened:

Let's try something with REPEAT 180. Try changing the other numbers in the command one at a time. Is there a way to make a circle if the REPEAT number is 180? Remember to write down any experiments you try.

What if we changed the REPEAT number to 90?

By now you've probably figured out that there are several different ways to make a circle — you already know three and you've also probably figured out if you change the REPEAT number, you'll also have to change the _____ number. See if you can figure out the missing numbers in these circle commands:

REPEAT 180 [FD 1 RT _____]

REPEAT 72 [FD 1 RT _____]

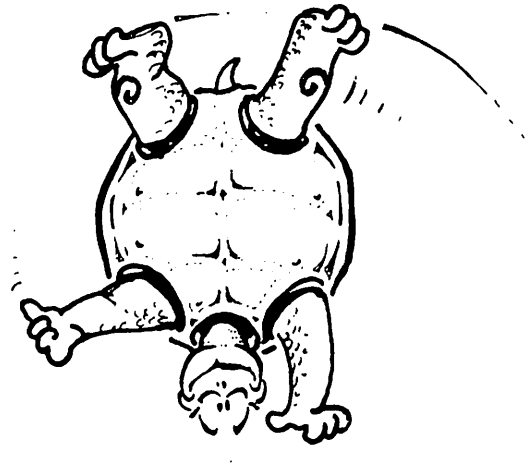
REPEAT 10 [FD 1 RT _____]

REPEAT _____ [FD 1 RT 4]

REPEAT 36 [FD 1 RT _____]

Have you figured out that if you multiply the REPEAT number by the RT number you'll get _____? That seems to be a very important number to the turtle.

What happens to the size of the circle as you change the amount the turtle turns each time? The more he turns (the higher the number), the _____ the circle.



There's another way to change the size of the circle. Choose one of the circle commands and this time try changing the FD number and keeping the other two numbers the same each time.

REPEAT 36 [FD ____ RT 10]

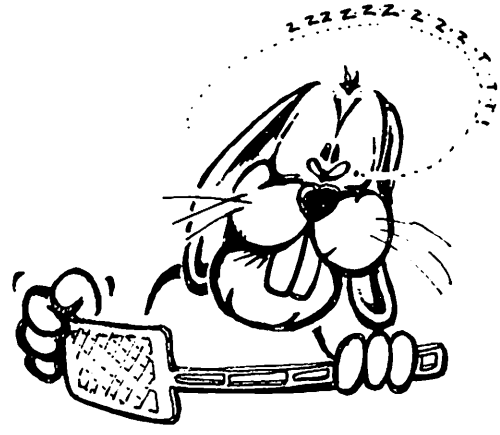
REPEAT 36 [FD ____ RT 10]

REPEAT 36 [FD ____ RT 10]

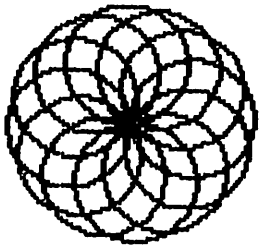
REPEAT 36 [FD ____ RT 10]

If you've tried all this experimenting, you're probably ready to try putting some circles together. Try some of these shapes or make up some of your own to try.

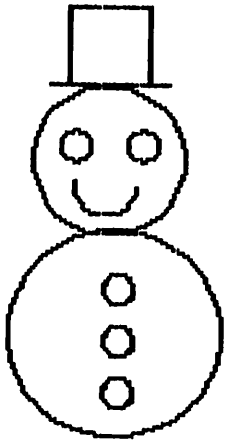
Eyes (**Hint** — You don't always have to turn right.)



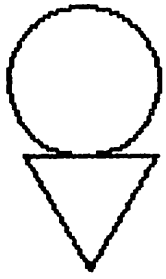
Flower



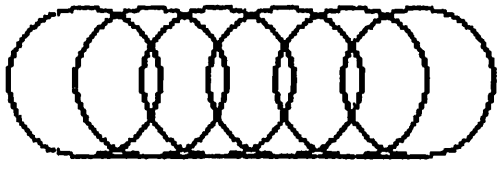
Snowman



Cone

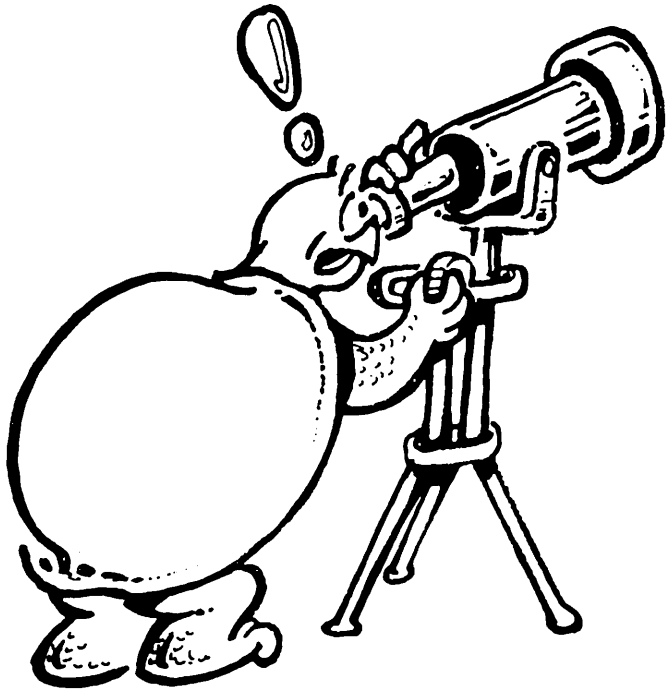


Slinky



NOTES

CHAPTER 3
VARIABLES

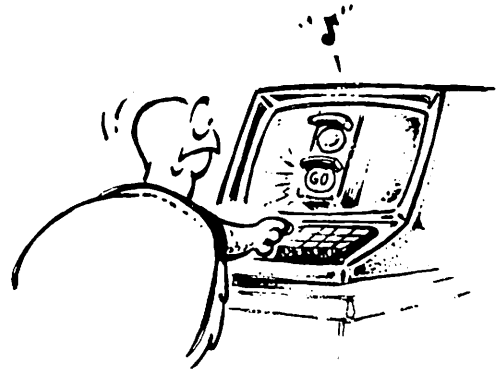


Three was a variable, Jack had so much fun.
He looked for a short-cut and, Wow! He found one!

USING VARIABLES

Our friendly turtle is always on the lookout for short-cuts. He really enjoyed making little boxes and big boxes and small circles and giant circles and little bitty triangles and medium-size ones. But it sure seemed like a lot of trouble to have to write a new procedure each time he wanted to draw a different size shape. He just knew there must be an easier way to do it.

Well, there is! It's called using a variable and here's how you do it. Instead of telling the turtle to go forward a certain number of steps, you tell him to go forward :N. :N??? Yep! :N. "N" stands for number, and each time you give the turtle the command to draw a shape, you will be able to change the number without writing a whole new procedure. Here goes.



This is the way the procedure should look:

```
TO BOX :N
REPEAT 4[FD :N RT 90]
END
```

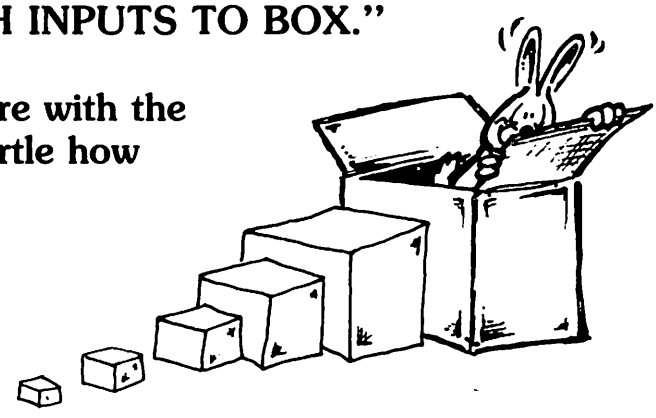
TI

First type TO BOX and press RETURN. When your screen changes to green, you'll see the cursor at the end of the first line right after the word BOX. Press the space bar and add :N. Then press RETURN to move the cursor down to the next line. Now type in your instructions for making a BOX, only when you tell the turtle how far forward to go, use :N again. To leave the edit mode, hold the _____ key down and press ____.

APPLE Type TO BOX :N and press RETURN. (The dots are found on the same row as the numbers.) Now type in the instructions for making a BOX, only when you tell the turtle how far forward to go, use :N again. To leave the edit mode, _____.

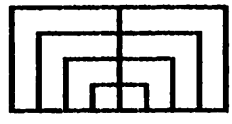
Great! You're all set to make any size BOX you want. Now the only tricky thing to remember is when you give the command BOX, you'll have to say what size BOX, like BOX 10 or BOX 27 or BOX 52 or whatever. If you forget to type in a number, you'll see the message "TELL ME MORE" or "NOT ENOUGH INPUTS TO BOX."

Using your new BOX procedure with the variable in it, can you tell the turtle how to draw these designs?

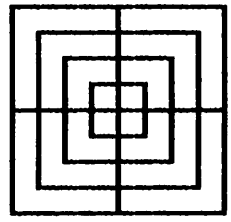


```
TO BOXES
BOX ___
BOX ___
BOX ___
BOX ___
END
```

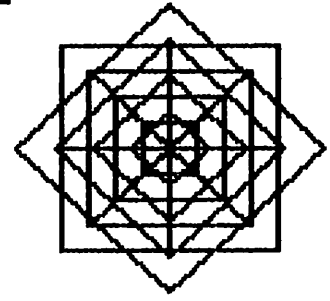
```
TO TABLES
BOXES
___ ___
BOXES
END
```



```
TO MIRROR
TABLES
___ ___
TABLES
END
```

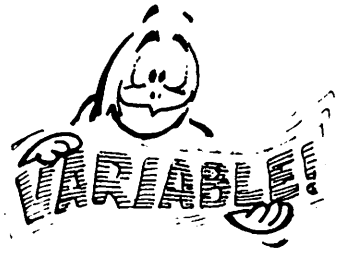


```
TO MIRRORS
___ ___
___ ___
___ ___
END
```



As you worked through these examples, did you notice that each new procedure used the one just before it as a command (or sub-procedure)? You could have defined MIRRORS by listing every BOX in the procedure. Wasn't it easier to define a small part of the design and then use it as a sub-procedure?!

Also, do you realize we are developing our very own computer language? There's no other language I know of that has a "MIRRORS" command. You can be as original and as creative as you want. It's your language!



Can you write a triangle procedure with a variable?

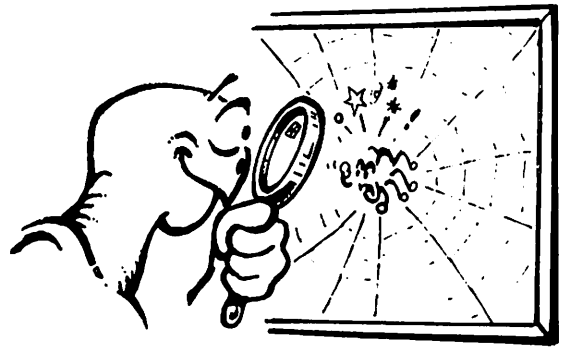
```
TO TRI _____
REPEAT ___ [FD _____ RT _____]
END
```

Here's a tricky thing you can do with variables. Use the procedure you just defined in a REPEAT command of another procedure like this:

```
TO HEXAGON :N
REPEAT 6 [TRI :N RT 60]
END
```

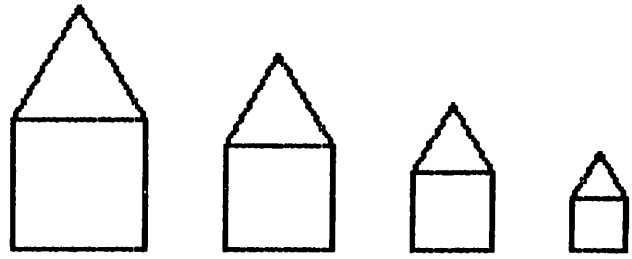
Now when you give the command HEXAGON, you'll have to tell the turtle how big to make each triangle within the procedure. Look at this spiderweb made out of HEXAGONs:

```
TO SPIDERWEB
HEXAGON 30
HEXAGON 40
HEXAGON 50
END
```



OK, your turn! Here's lots of space to work with your triangle variables:

Hey! Remember the HOUSE procedure? Can you figure out how to edit HOUSE so you can make all different sizes of HOUSEs? If you can do it, run all the way around the block and tell every third person you see!

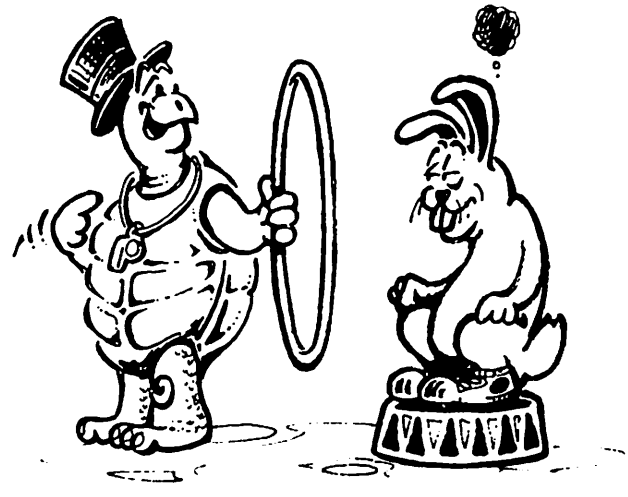


What could you add to the house procedure to make it more interesting?

Let's not forget the circle! Write a circle procedure with a variable:

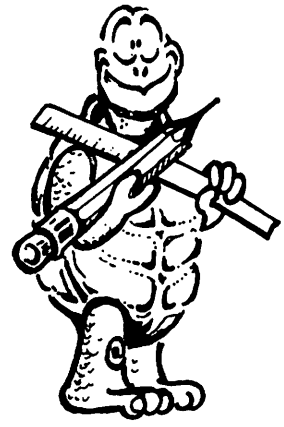
```
TO CIRCLE _____
_____________________________
END
```

Hmmmm. What can you do with circles?

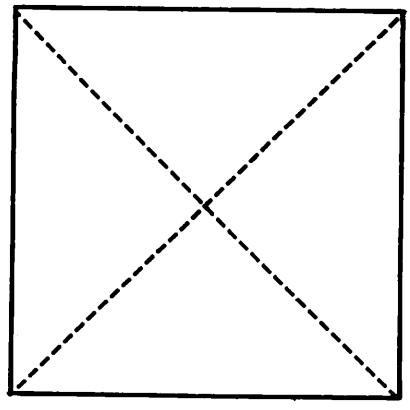


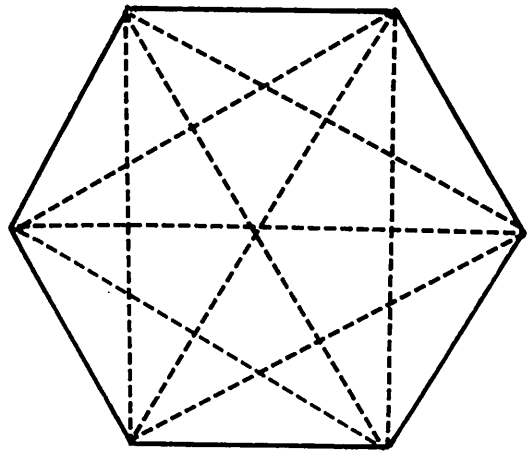
STARS AND PENTAGONS

After all that work, you deserve a great big STAR. Only thing is, though, you're going to have to figure out how to draw one!!!



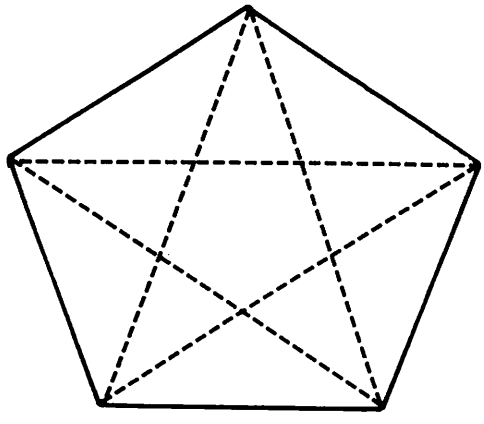
Get a sharp pencil and a ruler and let's design some stars! Did you know that if you draw diagonals on a pentagon (a figure with five equal sides), you'll make a perfect five-pointed star. A diagonal connects two corners of a figure like this:



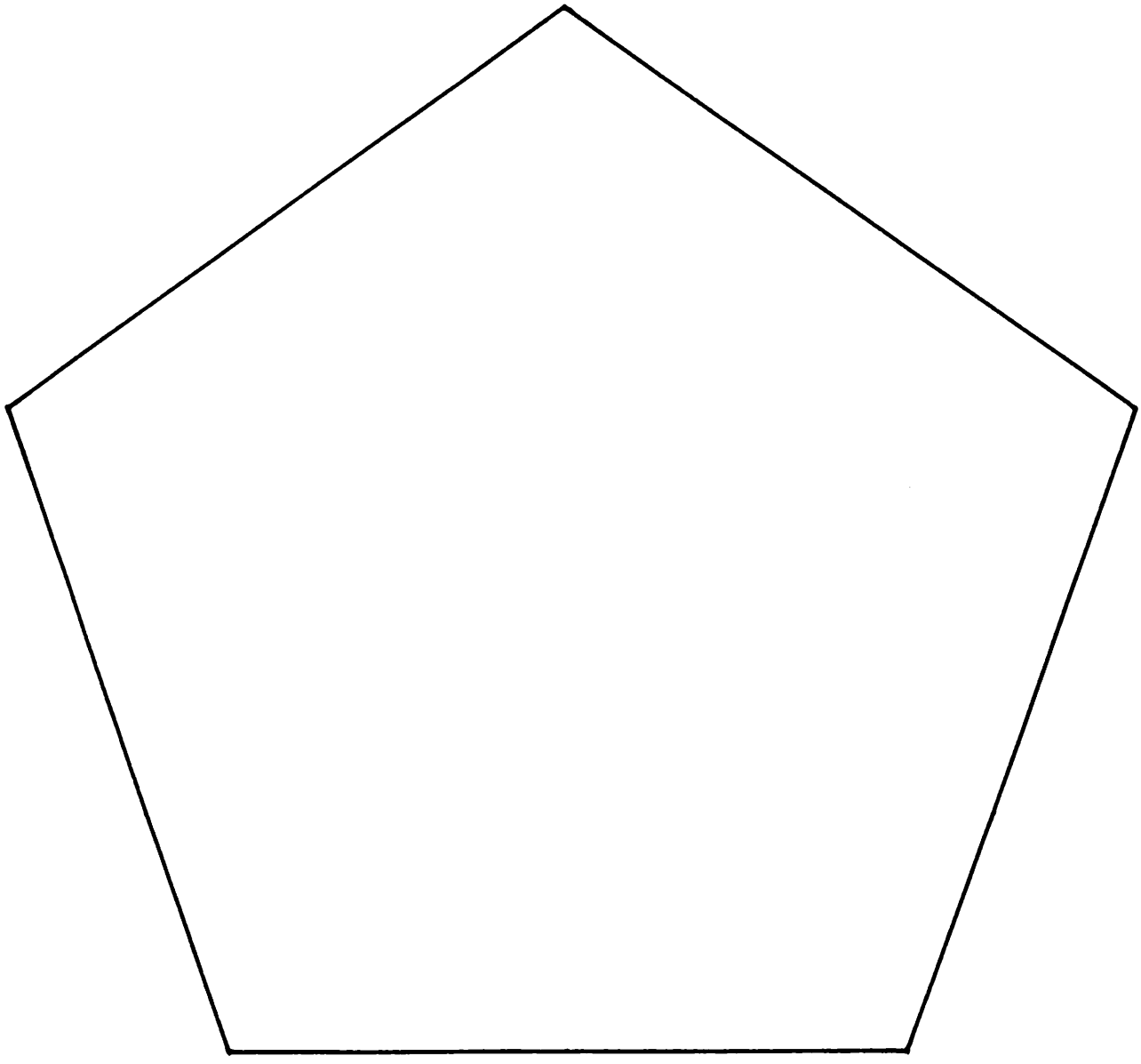


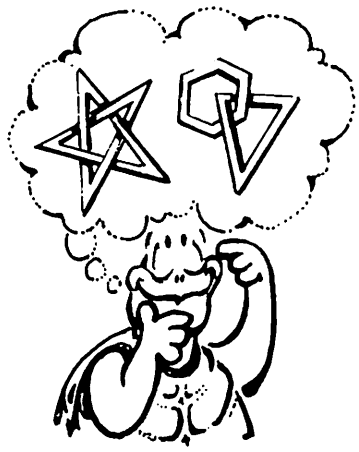
(The corners cannot be next to each other.)

Look at this pentagon. What happens when we draw the diagonals? Hey! Do you notice what's in the very center?
Another _____!



Here's a great big pentagon for you to play with. Draw the diagonals. Then when you see the smaller pentagon, draw its diagonals. How many times can you draw the diagonals until the figure gets too small to work with?





Now let's try to figure out how to get the turtle to draw a pentagon and a star.

This is another handy way to use variables - to help us figure out a missing piece of information. In this case, we know that both a pentagon and a star are drawn with five lines and each has five corners, right? So the turtle will have to REPEAT a forward command and a turn command five times. Since the size of the shape is up to us, we'll reach into a hat and pull out a number. I got 45. What did you get?

(Whoops, SIZE 7 won't work.
Pull out another one!)

So far, we have this much information:

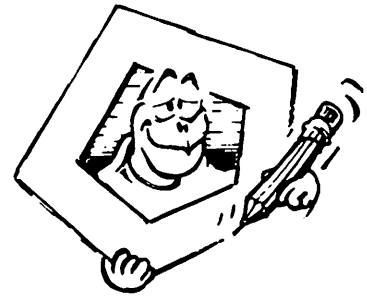
```
REPEAT 5 [FD 45 RT ____]
```

We could start playing around with that command until we found the right number. But since we already know how to use variables, we can save ourselves alot of typing by defining a procedure and then trying various numbers. Let's make it real easy to type. Let's call it PS (for pentagon and star).

```
TO PS :N
REPEAT 5 [FD 45 RT :N]
END
```

Now try lots of numbers and write down all the ones you try. Put a big red star beside the correct number for making a star and a pentagon beside the correct number for making a _____ — you got it!

I tried these numbers:



To make a STAR, the turtle must turn_____.

To make a PENTAGON, the turtle must turn_____.

Do you notice a relationship between these two numbers? (If you multiply _____ by _____, the answer is _____!)

When we first learned about variables, we used them to draw different sizes of the same shape. Now that you know how to draw a pentagon, can you write a procedure to draw any size pentagon you want? How about a star? You'll have to fill in the RT number and use the variable with the _____.

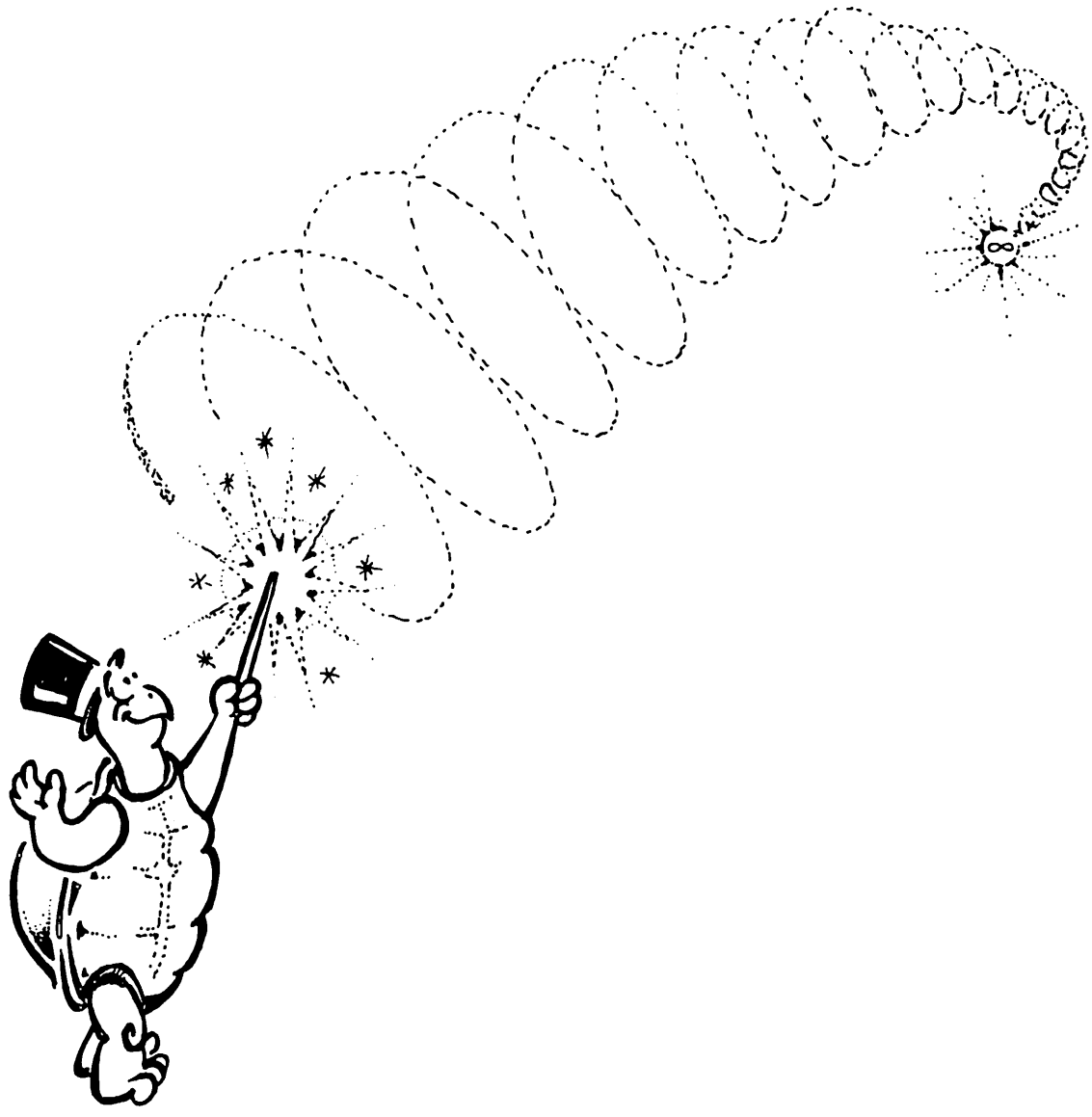
```
TO PENT____
REPEAT 5 [FD ____ RT ____]
END
```

```
TO STAR ____
REPEAT 5 [FD ____ RT ____]
END
```

Can you fill the screen with stars? Hey! Can you draw the Big Dipper?

Here's some space to doodle with stars and pentagons (and you can always include triangles, squares, and circles). Golly, we can draw just about anything now!

CHAPTER 4
RECURSION



Four was recursion so magically clever.
Danielle made a spiral that goes on forever.

PROCEDURES THAT USE THEMSELVES

A recursive procedure is one that uses itself. Huh? Well, it's kind of like looking into a mirror with another mirror behind you. How many of you do you see? It seems as if you go on forever!

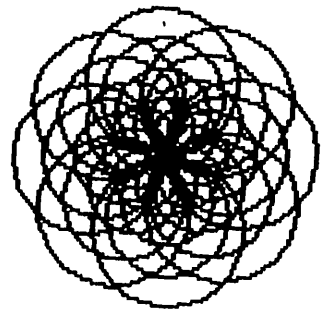
Why don't you go take a look?

The first image that you see is backward. Then it returns to normal in the second image. The next is backward and the next is normal. Make a sign and hold it up to the mirrors. See how the words are backward and then they return to read correctly.

This is a recurring pattern. It seems to go on forever. But how did that crazy rabbit get into our mirror?

One the computer, recursion seems almost magical. It gives you the chance to do all sorts of things over and over again. But this is a lot more than just repeating a procedure a number of times. Let's start a simple procedure that will keep repeating itself until your Mom calls you to dinner! Look at SPAGHETTI for example:

```
TO SPAGHETTI
CIRCLE 5
CIRCLE 4
CIRCLE 3
CIRCLE 2
RT 45
SPAGHETTI
END
```

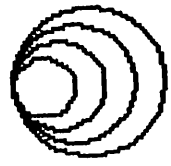


CIRCLE was defined with a variable like this:

```
TO CIRCLE :N
REPEAT 36 [FD :N RT 10]
END
```

After the turtle draws four circles, he will turn RT 45. Is that SPAGHETTI? Well, yes and no. Here's what it looks:

```
CIRCLE 5
CIRCLE 4
CIRCLE 3
CIRCLE 2
RT 45
```



That hardly looks like any spaghetti I've ever eaten. But if we could somehow get the turtle to use the procedure over and over, it might look a little more appetizing. So we use a recursive line to tell the turtle to do just that. When he reads the next line telling him to do the procedure called SPAGHETTI, guess what he does — SPAGHETTI! (CIRCLE 5, CIRCLE 4,CIRCLE 3, CIRCLE 2 and RT 45.) Every time he gets down to the spaghetti line, he does SPAGHETTI. And he'll do it over again and again and again until you stop him with:

TI 99/4 SHIFT Z

TI 99/4A FNCT 9

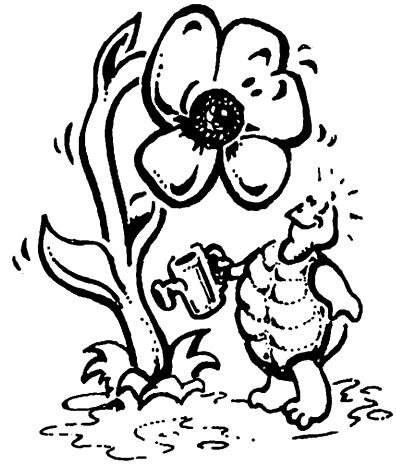
APPLE CTRL G

Now look back at some of the procedures you've defined and pick out a couple you can change to include a spaghetti line — I mean a recursive line. (Recursion reminds me of spaghetti because it's kind of hard to get a handle on. Once you do, though, there's nothing like it!)

Here are a couple of procedures the turtle came up with:

Remember those flower procedures we did? You can make them recursive.

```
TO FLOWER :N
SQUARE :N
RT 20
FLOWER :N
END
```



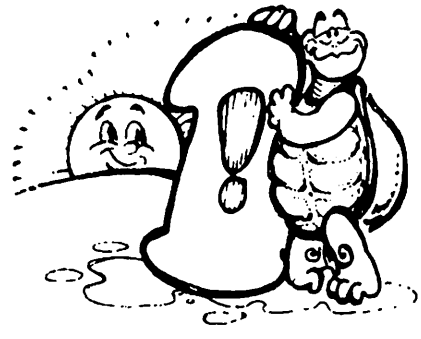
Notice how using the variable will allow you to draw any size flower you want! Be sure to use :N again in the recursive line.

Here is a procedure to draw a sun with triangles:

```
TO SUN
TRIANGLE 20
RT 60 FD 20 LT 30
SUN
END
```

Suppose you want to draw various sizes of suns. Just edit the procedure to include a variable:

```
TO SUN :N
TRIANGLE :N
RT 60 FD :N LT 30
SUN :N
END
```



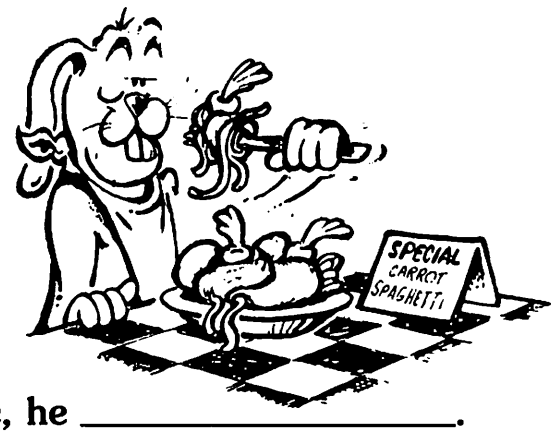
The designs we've drawn so far could have been drawn using a REPEAT command, only the turtle would have quit after he'd repeated the commands the number of times you told him to. In the color chapter, we'll add a changing color to the procedure so you can see that the turtle doesn't quit once he's drawn the design. He really does keep going. In the meantime, let's experiment some more.

Try turning RT 27 on the FLOWER procedure. What happens?

What can you do with the HOUSE procedure? Can you figure out how to write a recursive procedure to draw a suburb?

Write at least three recursive procedures of your own:

Do you like recursion?



A. Yes
B. No
C. I'm not sure yet
D. I'd rather have spaghetti

When the turtle "reads" a recursive line, he _____.

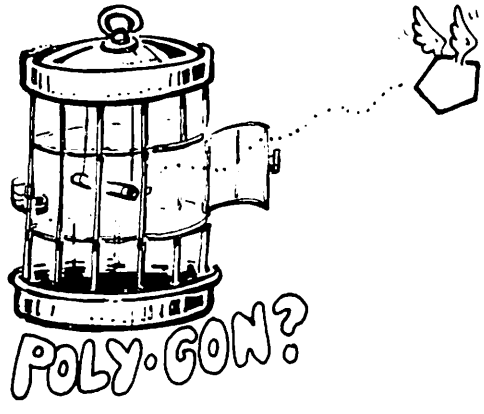
To stop a recursive procedure, press _____ _____.

Here is a recursive procedure with TWO variables. This is the first time we've used two variables in the same procedure. Instead of using :N for both of them, we'll have to use two different letters or the turtle will get very confused. (And the poor rabbit will never be the same.)

Let's use :A for the RT variable and :S for the FD variable. (A can stand for angle and S for side.)

```
TO POLYGON :S :A
FD :S
RT :A
POLYGON :S :A
END
```

When you give the command POLYGON, you'll have to type two numbers: one to tell the turtle how far to go forward on each side and one to tell him how much to turn. Try lots of numbers and write them down. Draw a sketch of what happens on the screen.



If you tried lots and lots of numbers you might have figured out that you can draw just about any shape you want with this one procedure!

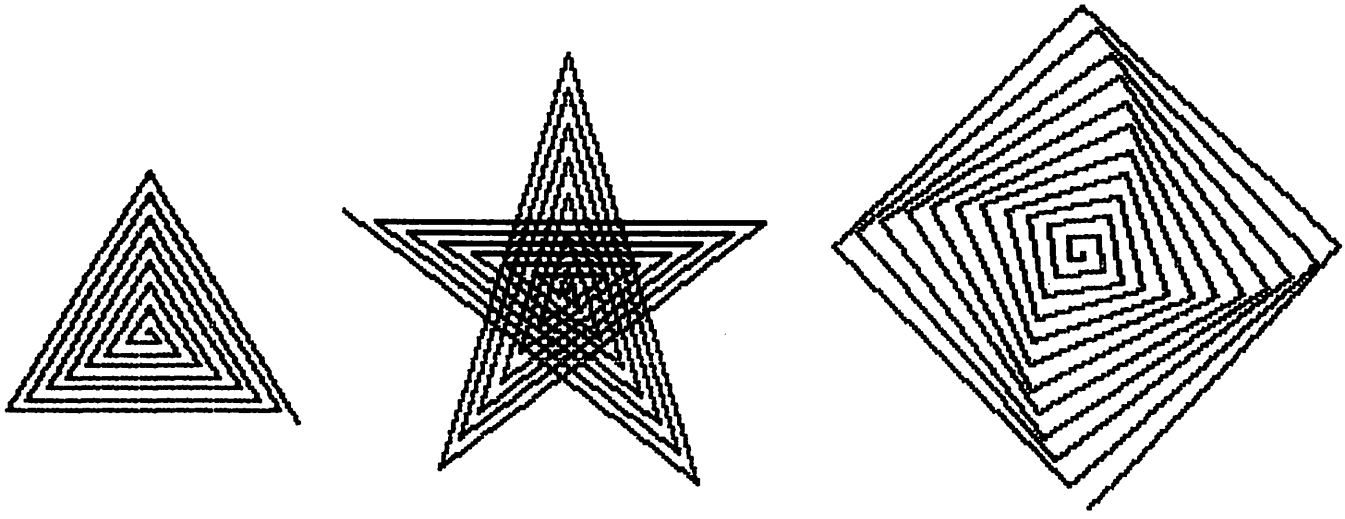
Now do you like recursion?

A. I already said yes.
B. Yes.
C. Ok, Rabbit, what'd you do with the sauce?

SPIRALS

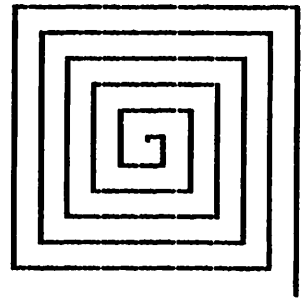
Sometimes it's fun to send the turtle on a spiral walk, around and around and around until he gets dizzy.

First, can you draw some spirals? Use colored pencils or crayons if you want so they'll be real colorful.



They're so much fun to draw, you might like to experiment with drawing different kinds of shapes, but right now, let's let the turtle have some fun, too.

Did you notice that when you were drawing a spiral, each side got just a little longer than the one before it? It's especially easy to see this on the square spiral. If the first line had a length of one turtle step, the second might be two turtle steps, the third might be three, etc. Each time the turtle draws a side, he'll have to add at least one more step. You can add five each time or three or any number you like.



Try this:

```
FD 5
RT 90
FD 6
RT 90
FD 7
RT 90
FD 8
```

You could keep going all day, but by now you're probably trying to figure out if there isn't a short-cut. You're right again — there is! And it's another procedure that uses a variable and recursion.

Try this:

```
TO SPIRAL :N
FD :N
RT 90
SPIRAL :N + 1
END
```

Look at the recursive line. This time, it not only tells the Turtle to do the procedure over, it also tells him to add 1 to the value of N. For example, if you give the command SPIRAL 12, the first FD command will tell the Turtle to go forward 12 steps. Then he'll turn 90. The next line tells him to go back to the top line and add one to the value of N. Now he'll have to go forward 13 steps. Each time he gets to the fourth line, he'll go back to the first command and add one more step to the distance he'll have to travel.

If you haven't tried it yet, do it now. It's one of those things you have to see to believe! By the way, he'll continue drawing until he runs out of ink or you stop him with _____ _____.

The Turtle is crazy about spirals, so try some different kinds. Try changing the RT turn. Try 89 or 144. Try changing the number in the fourth line to 3 or 5 or whatever.

TI The TI computer will run out of ink on some of these procedures. By experimenting with different numbers, see how big a spiral you can make before it does.

What if you start with a high number for the value of N and in the fourth line you have the Turtle subtract 1 instead of add 1???
Try this:

```
TO SUPERSPIRAL :N
FD :N
RT 88
SUPERSPIRAL :N - 2
END
```

Remember SPAGHETTI? (How could you forget it?) Well, try this!

```
TO SPAGHETTI :N
CIRCLE :N
RT 15
SPAGHETTI :N +1
END
```

Wow! Spiral SPAGHETTI!!!

NOTES

CHAPTER 5
COLORS, COLORS, COLORS

Five was a pocket of colors so bright.
Chad began drawing and stayed up all night.

In addition to drawing with a black pen on a blue-green background (TI) or a white pen on a black background (APPLE), the Turtle keeps several other colors in his pocket just in case you want them. You can also give him a different colored background!

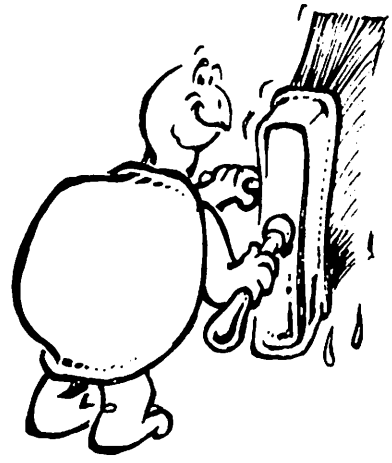
Here are all the colors he has:

TI

0 CLEAR
1 BLACK
2 GREEN
3 LIME
4 BLUE
5 SKY
6 RED
7 CYAN
8 RUST
9 ORANGE
10 YELLOW
11 LEMON
12 OLIVE
13 PURPLE
14 GRAY
15 WHITE

APPLE

0 BLACK
1 WHITE
2 GREEN
3 VIOLET
4 ORANGE
5 BLUE



First try changing the background:

TI Type CB (colorbackground) and the number of the color.

APPLE Type SETBG and the number of the color.

MIT Type BG and the number of the color.

Try one! Wow! Try another! Try all of them! Which do you like best?

How would you like to try a recursive procedure that cycles through some colors? We'll use a WAIT command so the screen will stay one color for awhile and then turn to another color. Since we're using WAIT 50, it's kind of like telling the computer to count to 50 before it reads the next command.

TI

```
TO RAINBOW
CB 13
WAIT 50
CB 6
WAIT 50
CB 9
WAIT 50
CB 10
WAIT 50
CB 2
WAIT 50
CB 4
RAINBOW
END
```

APPLE

```
TO RAINBOW
SETBG 3
WAIT 50
SETBG 4
WAIT 50
SETBG 2
WAIT 50
SETBG 5
WAIT 50
SETBG 1
WAIT 50
RAINBOW
END
```

MIT

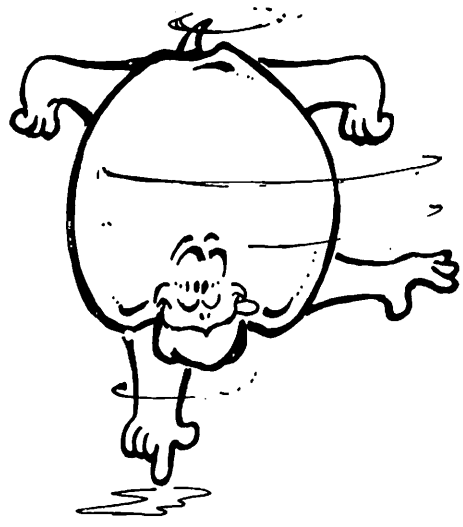
Hmm, there's no WAIT command in MIT LOGO so we'll have to define one.

MIT

There are many ways we can write a procedure to make time pass before the next command is carried out. Here's one way:

```
TO WAIT :T
REPEAT :T [REPEAT 4 [RT 90]]
END
```

Wow! A double bracket! This procedure will make the Turtle spin in a circle, but he's going to do it in four 90-degree turns, and he'll do it however many times (T) we tell him to.



Now we can define a RAINBOW in MIT:

```
TO RAINBOW
BG 3
WAIT 20
BG 4
WAIT 20
BG 2
WAIT 20
BG 5
WAIT 20
BG 1
WAIT 20
RAINBOW
END
```

After the Turtle defined a RAINBOW in each version of LOGO, he realized he was typing the same things over and over with only the number of the color changing. He wondered if he could define a procedure using a changing variable like he did with the spiral. So he tried this:

TI

```
TO RAINBOW :C      (for color)
CB :C
WAIT 50
RAINBOW :C + 1
END
```

APPLE

```
TO RAINBOW :C
SETBG :C
WAIT 50
RAINBOW :C + 1
END
```

MIT

```
TO RAINBOW :C
BG :C
WAIT 20
RAINBOW :C + 1
END
```

Uh oh! What happened? There's no color 16 on the TI and no color 6 on the APPLE. We'll have to add some kind of a statement to make the computer start over if it gets to 6 or 16. Here's what the turtle came up with:

TI IF :C > 15 MAKE "C :C - 15

MIT IF :C > 5 MAKE "C :C - 5

APPLE IF :C > 5 [MAKE "C :C - 5]

Let's read that in English. IF the value of C (color) is greater than 15 (5), THEN make the value of C that value minus 15 (5).

Everytime the computer "sees" an IF-THEN command, it tests the first part of the command and IF it is true, it carries out the second part of the command. For example, on the APPLE, IF C = 6, then the computer carries out the last part of the command by subtracting 5 to make the new value 1. It then goes on to the next command. IF the first part of the command is false (if C = 1, 2, 3, 4, or 5), it ignores the last part of that command and goes on to the next command.

Here's how the procedures look with the IF-THEN command included:

TI

```
TO RAINBOW :C
IF :C > 15 MAKE "C :C - 15
CB :C
WAIT 50
RAINBOW :C + 1
END
```

APPLE

```
TO RAINBOW :C
IF :C > 5 [MAKE "C :C - 5]
SETBG :C
WAIT 50
RAINBOW :C + 1
END
```

MIT

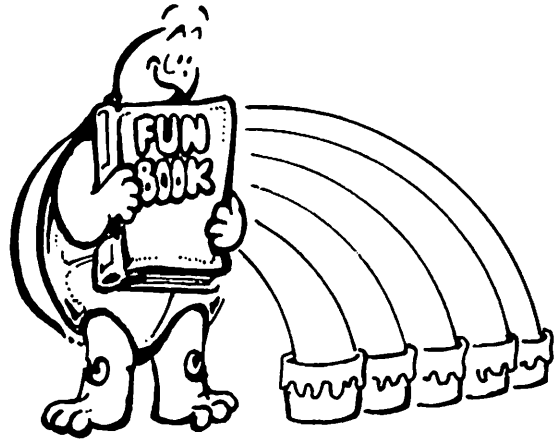
```
TO RAINBOW :C
IF :C > 5 MAKE "C :C - 5
BG :C
WAIT 20
RAINBOW :C + 1
END
```

Now let's change the pencolor!

TI Type SC (Setcolor) and the number of the color.

APPLE Type SETPC followed by the number of the color.

MIT Type PC followed by the number of the color.



Do you know what the Turtle did when he discovered he had all those beautiful colors in his pocket? He went back through this Funbook and did all of the designs over in his favorite colors! Then he tried mixing colors — doing one design, then changing pencolor and doing it again on another part of the screen.

He went back to the recursion chapter and had a great time adding color to some of those procedures. To make the colors change, he had to include an IF-THEN command. Here's how he did SUN:

TI

```
TO SUN :N :C
IF :C > 15 MAKE "C :C-15
SC :C
TRIANGLE :N
RT 60 FD :N LT 30
SUN :N :C+1
END
```

APPLE

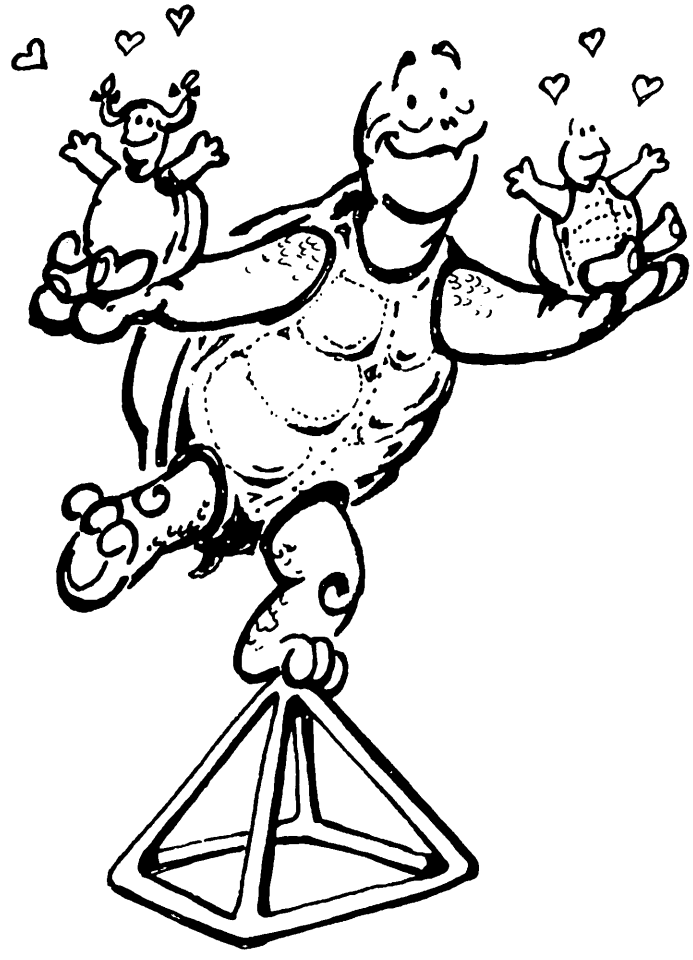
```
TO SUN :N :C
IF :C  >  5 [MAKE "C :C-5]
SETPC :C
TRIANGLE :N
RT 60 FD :N LT 30
SUN :N :C + 1
END
```

MIT

```
TO SUN :N :C
IF :C  >  5 MAKE "C :C-5
PC :C
TRIANGLE :N
RT 60 FD :N LT 30
SUN :N :C +1
END
```

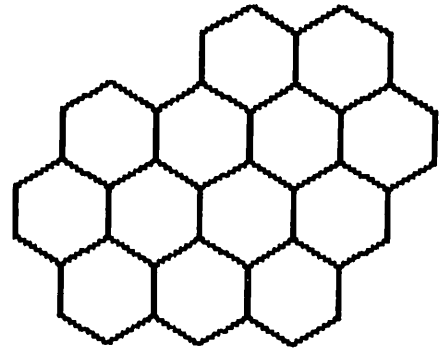
Can you add color to some of the other recursion procedures? What else are you going to do?

CHAPTER 6
MORE IDEAS



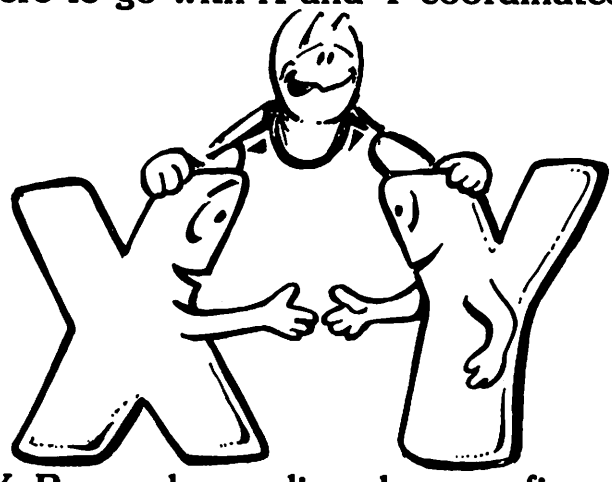
Six was an idea that grew and grew.
I love my Turtle and hope you do, too!

Your teacher asked you to turn in a diagram of a honeycomb and you just know you can get the Turtle to do your assignment for you.

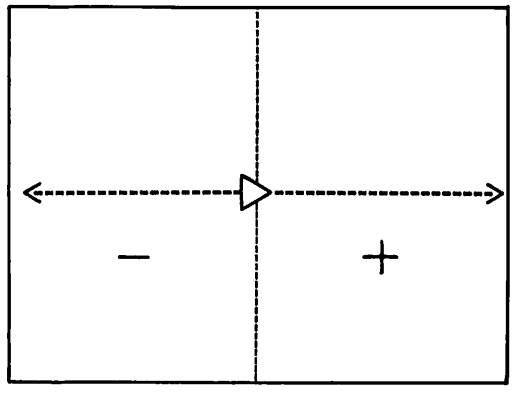


Here is a whole Indian Village of teepees. Draw a different design on each one and then have the Turtle draw one on the screen. (Don't forget to add some color!)

Suppose you want to draw a whole Indian village on the screen. There are two different ways to move the Turtle to the position where you want him to start drawing. You already know one. Use PENUP and PENDOWN and move him with FD, BK, RT and LT. You can also tell the Turtle exactly where to go with X and Y coordinates.



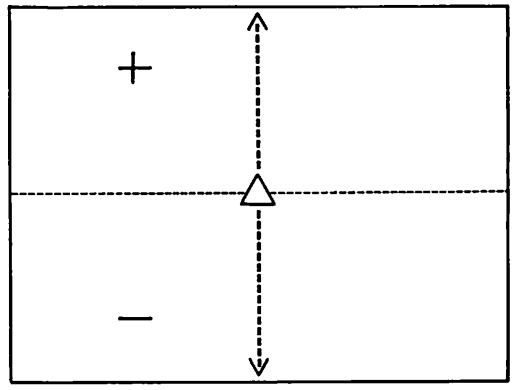
Let's start with X. Remember earlier when you figured out how many steps the Turtle could take from HOME to the left side of the screen and how far he could go to the right? Think of the steps to the right of HOME as positive and those to the left as a negative.



You can tell the Turtle where to go by SX (TI) or SETX (APPLE) followed by a space and either a positive or a negative number. So, put the PENUP and hop your Turtle!

TI	**APPLE**
SX 71	SETX 71
SX -15	SETX -15
SX 90	SETX 90
SX -85	SETX -85
____ _____	_____ _____
____ _____	_____ _____

What about up and down? We'll use the Y positions to take care of that. The positions above HOME are positive and those below are negative.

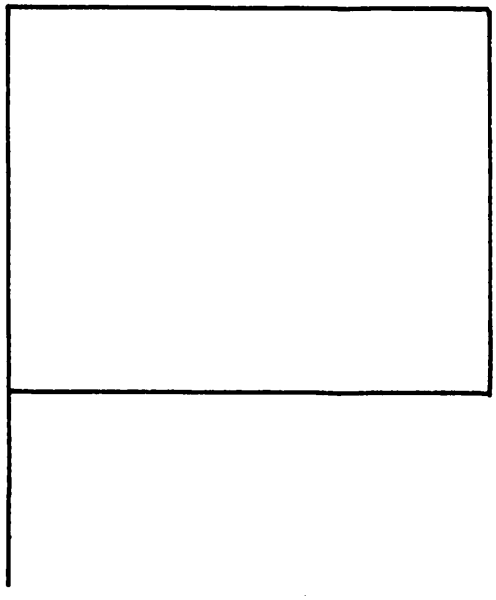


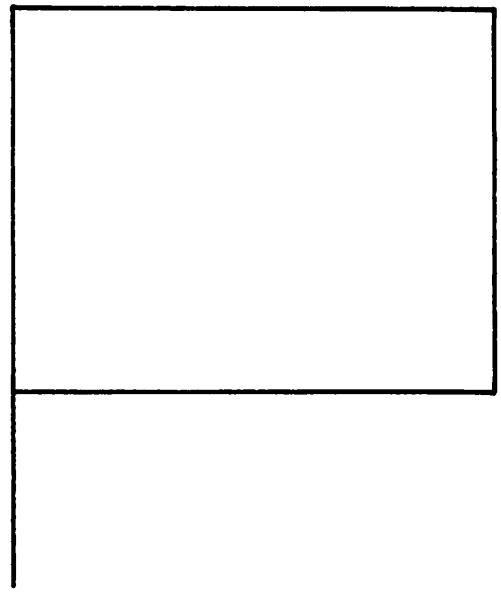
Use SY (TI) or SETY (APPLE) followed by a positive or a negative number and watch the Turtle hop up and down:

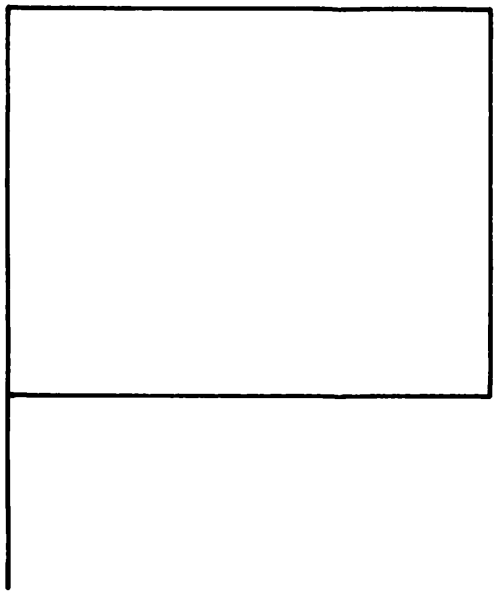
TI	**APPLE**
SY 40	SETY 40
SY -113	SETY -113
SY 0	SETY 0
SY 82	SETY 82
____ ____	____ ____
____ ____	____ ____

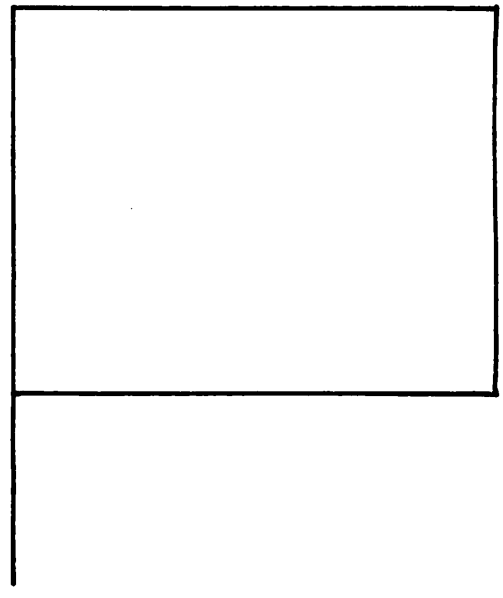
What do you suppose will happen if you give the Turtle an X command followed by a Y command? Try it! See if you can figure out how to hop the Turtle from corner to corner! If you can do it, you're in line for the famous Hopping Turtle Award!

Meanwhile, you've just been selected by your City Council to design a new flag for the courthouse, so back to the drawing board!

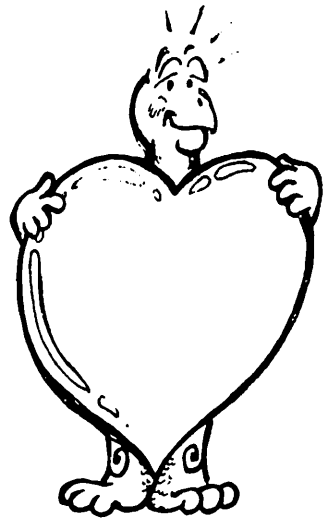








A greeting card company has just learned of your computer work and wants you to design a card for your favorite holiday.



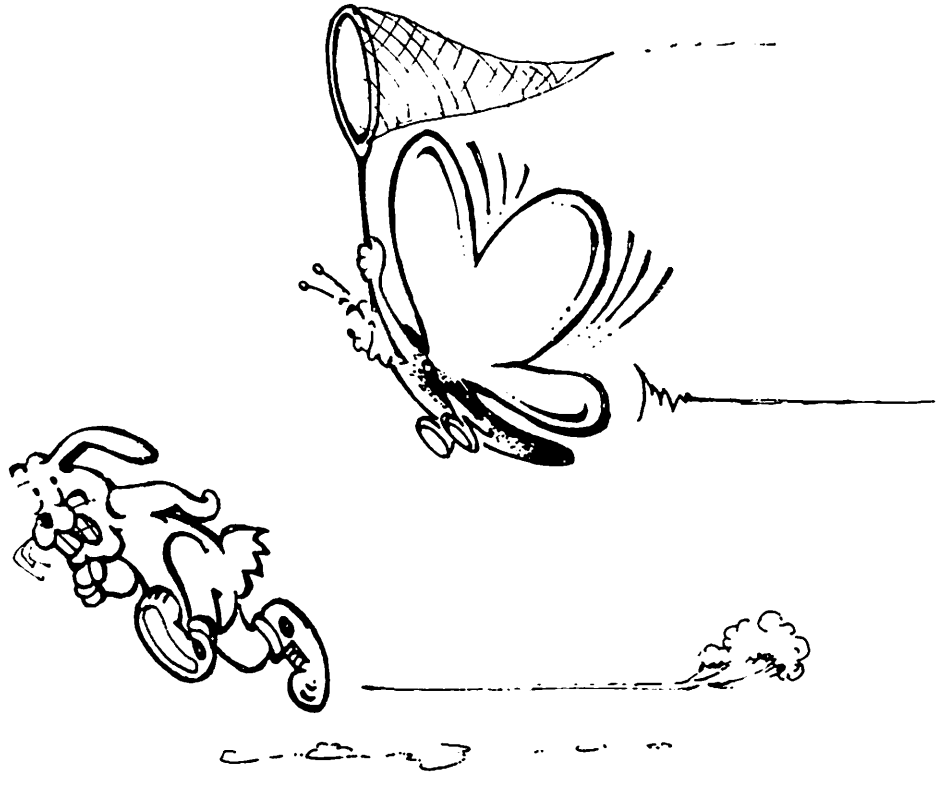
A spaceship just landed and the weirdest looking Martian just stepped out. Have the Turtle draw the Martian.

Draw the spaceship.

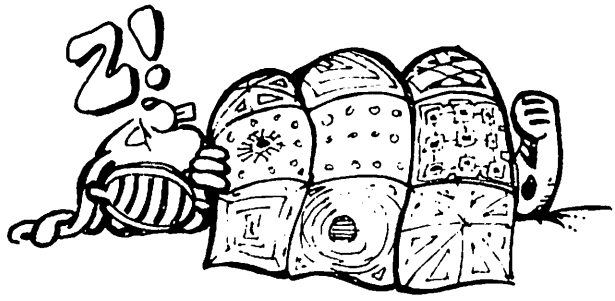
Draw the expression on your face when you saw the Martian.

A giant caterpiller just crawled across the screen

and then turned into a beautiful butterfly.



Study the pattern on a linoleum floor or some wallpaper or one of your Grandmother's quilts — anything that has repeating shapes. Design a repeating pattern and then see if you can help the Turtle draw one on the screen.



EDITING FEATURES
For APPLE LOGO, MIT LOGO, and TI LOGO

EDITING FEATURES

TI 99/4

SHIFT W	Moves cursor to beginning of line
SHIFT V	Moves cursor to end of line
SHIFT ↑	Moves cursor up one line
SHIFT ↓	Moves cursor down one line
SHIFT ←	Moves cursor one space to left
SHIFT →	Moves cursor one space to right
ENTER	If cursor is at the end of a line, opens a space for a new line. Otherwise moves the cursor, the character immediately above it and everything to the right down to the next line.
SHIFT T	Erases the character or space one space to the left of the cursor. If the cursor is under the first character of a line, moves line up one line.
SHIFT F	Erases the character or space immediately above the cursor. If the cursor is at the end of a line, moves next line up.
SHIFT C	Erases the character or space above the cursor and everything to its right.
SHIFT Z	Leaves the Edit Mode

TI 99/4A

FNCT 5	Moves cursor to beginning of line
FNCT 6	Moves cursor to end of line
FNCT ↑	Moves cursor up one line
FNCT ↓	Moves cursor down one line
FNCT ←	Moves cursor one space to left
FNCT →	Moves cursor one space to right
ENTER	If cursor is at the end of a line, opens a space for a new line. Otherwise moves the cursor, the character immediately above it and everything to the right down to the next line.
FNCT 3	Erases the character or space one space to the left of the cursor. If the cursor is under the first character of a line, moves line up one line.
FNCT 1	Erases the character or space immediately above the cursor. If the cursor is at the end of a line, moves next line up.
FNCT 4	Erases the character or space above the cursor and everything to its right.
FNCT 9	Leaves the Edit Mode.

APPLE

CTRL B	Moves cursor back one space without changing procedure.
CTRL F	Moves cursor forward one space.
→	Moves cursor forward one space.
←	Erases the character or space one space to the left of the cursor. If the cursor is at beginning of text line, moves entire line to end of previous line.
CTRL N	Moves cursor down to next line
CTRL P	Moves cursor up to previous line
CTRL A	Moves cursor to beginning of current line
CTRL E	Moves cursor to end of current line.
CTRL D	Deletes character directly behind cursor.
CTRL C	Defines procedure as is, leaves edit mode.
CTRL G	Aborts editing, leaves edit mode.

MIT

←	Moves cursor back one space.
→	Moves cursor forward one space.
CTRL N	Moves cursor down to next line.
CTRL P	Moves cursor up to previous line.
CTRL A	Moves cursor to beginning of current line.
CTRL E	Moves cursor to end of current line.
CTRL D	Deletes character directly under cursor.
CTRL K	Deletes (kills) a line from cursor to end.
CTRL O	Opens a space to insert a new line.
CTRL C	Defines procedure as is, leaves edit mode.
CTRL G	Aborts editing, leaves edit mode.

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1,2,3 MY COMPUTER & ME!

DONNA BEARDEN

A LOGO FUNBOOK FOR KIDS

Join the escapades of the legendary tortoise and hare's computer relatives, the turtle and the rabbit. 1, 2, 3, MY COMPUTER AND ME is a "fun book" that teaches your child the basic problem-solving concepts of LOGO by using turtle graphics. Your child will discover and understand LOGO's graphics through the book's many activities. Some of the activities are for use with the computer and some are not. Filled with light-hearted illustrations, this book allows youngsters to test, explore, and discover using their creativity and imagination. An excellent introduction to Apple and TI 99 versions of LOGO from the Young People's LOGO Association, 1, 2, 3, MY COMPUTER AND ME invites you and your child into a world of powerful mathematical ideas and into the world of your own thoughts and imaginations. Enjoy it!

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